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ETRANGER . . . . 15 „ „

ERRATA

Page 308, 15th line

drops by 1°.24 instead of to 1°.24

Page 309, 6th line *from bottom*

The theoretical yield must be multiplied by the factory's efficiency factor............

12th line *from bottom*

+ 1.58 instead of + 1.31

Page 110, 8th line

should be $\frac{11.35}{11.455} = .9908$ or 99.08 %

instead of $\frac{11.35}{11.455}$ 9908

LA COUPE DE 1947

J. René LAGESSE
Statisticien, Département d'Agriculture

La production de sucre pour 1947 a atteint le poids record de 350,000 tonnes métriques. Le chiffre exact n'est pas encore connu, mais il sera probablement de l'ordre indiqué plus haut, ou légèrement plus grand.

Ceci constitue donc un magnifique record pour Maurice. La production la plus élevée avant 1947 est celle de 1942 où 330,000 tonnes métriques de sucre furent produites.

Le tableau suivant fait voir le sucre produit de 1940 à 1947 inclusivement :

Années	Sucre réalisé mille tonnes métriques	
1940	316.25	
41	323.68	
42	330.88	
43	310.72	Instauration de culture de plantes vivrières.
44	199.64	Culture de plantes vivrières et cyclone.
45	139.05	3 Cyclones.
46	291.06	Remise sous culture de la canne de terrains qui servaient à la culture des plantes vivrières.
47	350.00	Retour à la canne complètement.

La nature a été particulièrement clémente pour nous en 1947, et les raisons qui pourraient expliquer la production record de l'année sous revue sont :

1o. Les conditions climatiques exceptionnelles qui ont prévalu en novembre 1946. En effet, ce mois fut très pluvieux et tous les districts furent abondamment arrosés. Les plantations eurent donc un départ excellent.

2o. L'Ile ne fut atteint sérieusement par aucun cyclone.

3o. Des pluies très favorables qui tombèrent en avril et en juin dont les districts du Nord en bénéficièrent particulièrement.

4o. Une température au-dessous de la normale d'août à novembre qui favorisa la maturation.

5o. La remise sous culture en canne de terrains consacrés à la culture des plantes vivrières en 1946 et 1947 qui résulta en une forte proportion de vierges et de premières repousses.

6o. La grande extension donnée à la culture de la M 134/32. Il est à noter que l'incidence de la maladie de la Morve Rouge sur cette variété fut en régression l'année dernière.

Il est regrettable que nous ne puissions avoir les chiffres exacts pour montrer les rendements aux champs et à l'usine. La compilation de ces renseignements se fait à l'heure actuelle et dès que nous serons en leur possession nous complèterons cet articulet par une étude plus détaillée qui paraîtra, nous l'espérons, dans un des prochains numéros de la Revue Agricole.

A REPORT BY MR. R. D'AVICE, REGISTRAR CENTRAL BOARD, on his Mission to South Africa

(Presented to the Mauritius Chamber of Agriculture)

Réduit,
12th August 1947.

The President
and Members,
The Mauritius Chamber of Agriculture,
Port-Louis.
(through the Director of Agriculture)

Gentlemen,

I have the honour to submit herewith a report relative to my visit to the Union of South Africa.

The first part refers to the weighing of juice and imbibition water in the Natal and Zululand Sugar Factories. I was requested to enquire into the use of weighing scales, automatic counters and recorders. I have thought it advisable to extend somewhat the scope of my enquiries and to review, in the first instance, the methods used in Mauritius so that the progess which has been realised in South Africa might be better brought to light.

The second part deals with the results obtained with the Oliver-Campbell cane mud continuous filter. I have stayed three days at Maidstone factory, three days at Amatikulu, I have visited most of the other factories and have had the opportunity of discussing at length our problems with several of the Sugar Engineers and Technologists of Natal and Zululand.

Mr. O. d'Hotman de Villiers has, in 1942, in a communication to the Mauritius Industry Sugar Reserve Fund, reviewed in a very able manner the technique used in the South Africa Sugar Industry. He has made special reference to the plants which might be of interest to the Mauritius Sugar Industry. I would like to add a few short notes which might be of interest.

1. Mr. O. d'Hotman de Villiers has discussed at length the necessity of improving the efficiency of our steam-producing plants so as to cope with canes of low fibre content and has made valuable recommendations to that effect. There is nothing much which I could add to those recommendations, but I would like to mention that I have come across cases where

important saving in fuel has been made by substituting fire tube boilers for water tube boilers working with Murray furnaces (the advantages of which have been pointed out by Mr. d'Hotman) and senior economisers with rigid control by means of flow meters and CO_2 recorders. Senior economisers are designed so as to give straight-through gas passages of uniform cross-sectional area, heating surfaces remain free from dust accumulations ensuing maximum rate of heat transfer.

The efficiency of a sugar factory depends on a proper balance between three inter-related but quite distinct plants : steam raising, cane crushing and sugar manufacture in relation to production. For any given size of mills the crushing rate in South Africa is much higher than in Mauritius. I may quote one factory having one crusher and four mills 33" x 66" which manipulates 68 tons of canes (16 o/o fibre) per hour. The use of inter-mesh rollers from first to last mill have made that possible.

In certain cases, the last mill rollers do not inter-mesh, they are then heavily grooved. We should consider the possibility of higher crushing rate with a view to helping to solve the fuel problem.

Roller bagasse feeders are much in favour, they practically eliminate all choking of mills. The surface speed of the rollers is 10 to 15 o/o higher than the speed of the layer bagasse.

2. A strainer of special design (Coulter Apron type) supplied by the Mirlees Watson Cy. Ltd. which takes the place of the cush-cush is being fitted in one of the factories. The strainer has the shape of an inverted V, it is very simple in construction, contains no moving parts and is placed on top of the bagasse carrier.

3. Automatic liming device of the Gelly type by which the rate of flow of milk of lime is regulated by the inflow of juice.

4. Ion exchange applied to sugar juice purification. Experiments are being carried out at Darnall with a pilot plant, which has been supplied by the Dorr Cy., U.S.A., for the clarification of juice by means of synthetic resinous exchanges. By means of cation exchanges, most of the non sugars are removed (resulting in very high recovery), the acids formed during the process are next removed by anion exchanges. So far as increase in purity is concerned, results obtained are satisfactory, but no conclusion has yet been arrived at concerning the economic aspects of the process.

5. Fletcher center flow vacuum pans. Those pans are giving excellent service in a number of factories. The centre feed device, the large down take tube, the streamlined bottom and even distribution of steam into a number of sections ensure rapid circulation and uniform conditions of temperature and concentration throughout the massecuite. The rate of evaporation is as high as 12 lbs per sq. inch under a vacuum of 26 inches with steam at 7 lbs per sq. inch. Important saving in time is effected.

6. High speed electrical centrifugals (Pott Cassels and Williamson) with automatic control of operations. The machines are started by pressing a button and are automatically stopped, the time of spinning and the

amount of water used for curing as well as the period of application are automatically controlled. The sugar is removed by means of ploughs. The use of those centrifugals has resulted in increased production and reduced costs.

7. The use of absolute alcohol (manufactured from molasses) as fuel. The alcohol is in great demand by motorists, it is generally used in the proportion of 25 alcohol and 75 petrol. The advantages of low carbon formation and high octane value is of particular interest under present conditions when poor quality petrol is available and high compression engines manufactured.

8. Considerable progress has been made recently in the technique of metal welding. The use of eutectic low temperature welding rods (manufactured in U.S.A.) has made possible the repairs of practically all details and constructions in the factory. By means of eutectic rods it is possible to make strong bonds with steel, iron, copper, brass, bronze and aluminium alloys at relatively low base metal heat. The ill effects of arc-welding due to stresses, distortion and metallurgical changes in the base metal caused by high temperature are greatly reduced. Eutectic rods may be used with oxy-acetylene as well as with arc-welding.

The third part of the report refers to the technique of stone crushing followed in the Transvaal gold mines. My instructions were to find out what would be the machines, of a totally portable type, which would be the most suitable for breaking basalt stones of a size varying from a few inches to six feet or more and reducing them to particles of about ¼" size. On my arrival in South Africa, I spent twelve days at Johannesburg and before I left I spent another three days there on a second visit. I have visited seven gold mines and have seen quite a number of stone-crushing plants in operation. I have had the occasion of discussing the problem which concerns us with several mine engineers from whom I have been able to obtain impartial opinion.

I wish to express my sincere thanks and indebtedness to the management and staff of the Experimental Station, the Sugar Industry Central Board, the Sugar Millers' Association, the Sugar Factories and to the following firms and corporations for the valuable assistance given : Messrs Edward L. Bateman, (Pty) Ltd., Gilbert Hamer & Co. Ltd., J. H. Vivian & Co. Ltd., Patrick Murray (Pty) Ltd., The South African Scale Co. Ltd. Stafford Mayer Co. (S.A.) Ltd., The Anglo-American Corporation and to the Union Corporation.

I am also grateful to the President of the Mauritius Chamber of Agriculture, the Director of Agriculture, the Dorr Co. Inc. (through Messrs Adam & Cie.) Messrs Tardieu & Cie, George Fletcher & Co. Ltd., (through Messrs Rey & Lenferna, Ltd), Messrs Blyth Bros. & Cy. and to the Manager of the Barclays Bank (D. C. & O.) for the letters of introduction which have been of great help to me.

I am, Gentlemen,

Yours faithfully,

R. AVICE.

PART I

The Chemical and Industrial Control of Sugar Factories

There is at present a world shortage of sugar, but the consensus of informed opinion is that in 1950 or 1951 production will exceed consumption. It will then become necessary, more than ever, to secure in our factories high efficiency so as to produce sugar as cheaply as possible and enable our staple industry to survive. In the sugar industry, as in other industries, high efficiency may only be obtained if the losses incurred during each stage of manufacture are detected and steps taken so as to reduce them to a minimum.

Adequate control in a sugar factory comprises :

(a) correct weights,
(b) correct samples,
(c) correct analyses.

A factory will derive no advantage if two of the above operations are carried out saticfactorily whilst the third one is lacking in accuracy ; on the contrary, that might lead to erroneous and give one a feeling of security while sugar which might have been bagged is going to waste. So far as methods of sampling and analyses are concerned, the " Société des Chimistes et des Techniciens des Industries Agricoles de l'Ile Maurice " issues from time to time recommendations on the subject and a Technical Committee of the " Société " appointed in 1945 to deal with the Chemical and Industrial Control of Factories is at present engaged in the drafting of a pamphlet giving up-to-date methods of control. Uniformity of sampling and analysis is essential so that figures from different factories might be comparable. It is hoped that the time is not remote when the recommended methods of sampling, analyses and calculations will be adopted by one and all.

For the correct accountancy of sugar it is essential to know the accurate weights of the following materials :

Cane,
Mixed Juice,
Imbibition Water,
Sugar.

The weighing of syrup, final molasses and filter-press cakes though not so essential, leads to a closer control and enables undetermined losses to be calculated. The direct weighing of bagasse instead of the calculation of its weight by the use of the fundamental equation *cane + water = mixed juice + bagasse* would show to what degree of accuracy the weighing of the other substances is done, but up to the present no practical weighing machine for bagasse has been designed. Requirements for efficiency weighing are minimum time and labour, minimum human and mechanical error.

WEIGHING PRACTICE IN MAURITIUS

Cane

There are about 185 cane weighing machines in Mauritius. They are all of the platform weighing scale type fitted with hand regulated beams. Most of them have a device for stamping the weight on a ticket but few of the devices are in working order. Errors may be made in reading or recording the weights, but in general the weighing of canes in well done. The necessity of frequent inspections, cleaning the working mechanism of knife surfaces and bearings and proper lubrication is more and more recognised. The presence of dirt and other foreign matters on the levers (specially the last levers) is often the cause of an error in weight. An efficient service for the supervision of the accuracy of cane weighbridges and checking of the/weighing of canes is maintained by the Central Board. A few of the weighbridges are, however, in a poor mechanical condition and should be renewed at an early date. A point which is unfortunately not borne in mind is that often many hours elapse between weighing and crushing, the canes during that period lose or gain weight according to weather conditions and this has an influence on the weight of bagasse and consequently on the accuracy of the determination of sucrose content of cane. Also the cane carrier is not housed, so that during rainy weather an appreciable amount of water is carried to the mills, especially in installations comprising a set of knives at the bottom of the cane carrier. The usual deduction made on planters' canes for trash, roots and white tops (i.e. 10 kilos per vehicle or 1 c/o on cane) should not be taken into consideration for factory control.

It might be mentioned that the weighbridge house is usually a very small building badly aerated, badly lighted and not insulated. More comfortable housing would be a great asset to the weigher during the many hours of arduous work he has to perform.

Mixed Juice

The whole control of the factory depends on the accuracy of the weight of the mixed juice. In order to ascertain the sucrose content of the cane and the losses incurred in the manufacturing process, it is essential to determine accurately the weight of mixed juice. It must be borne in mind that nowadays planters' canes ara mostly purchased on the basis of their extraction and that an error in the determination of the average sucrose content might mean and important financial loss to the factory.

Scales for weighing juices may be divided into two classes: non automatic scales which require the constant presence of a weighman and automatic scales which are labour-saving devices. In Mauritius, no automatic scales are in nse.

One of our factories possesses a Howe Scale (see Appendix) for the weighing of mixed juice. The device for stamping the weight is out of

action so that both the weighing and the recording depend on the skill and efficiency of the operator. The Howe Scale is very accurate when the attendant does his work conscientiously. Six factories possess beam scales which were formerly used for cane weighing. Here again, much depends on the human element. In at least one case it is evident from the figures obtained that the weight found is not correct.

In 16 factories the mixed juice is measured by means of automatic measuring tanks of the Rey or Ménagé patent. In the other factories the juice is measured in calibrated tanks and the old system of "Peg Boards" which is quite unsatisfactory is favoured, no guarantee can be obtainod that the attendant is doing his work properly. It is unfortunate that counters operated by the opening or closing of the discharge valves are not used to check the record of the attendant. Bristol recorders which indicate whether the tanks are each time properly filled and emptied and which may also serve as a counter would be of great value.

The weight of the juice is obtained by multiplying the volume found by the density. A certain percentage is deducted from the volume found to account for the presence of air, frothing etc., the figure is not the same in all factories and varies with the amount of air contained in the juice, reagents used to prevent fermentation, etc. The weight obtained from the cubic measurement of the juice leads to unavoidable inaccuracies of notable magnitude due mainly to :

(a) Presence of solid particles.

(b) Psesence of air, scum and froth.

(c) Expansion or contraction of measuring tanks due to difference in temperature.

(d) Possible errors in the determination of the density.

The International Society of Sugarcane Technologists recommends that mixed juice be weighed and not measured. In general, the weight of mixed juice in our factories is not correctly determined and there is room for great improvement. During recent years, I have had the occasion of enquiring into a number of cases and have found the control far from being satisfactory. Apart from the unavoidable inaccuracies mentioned above, other sources of errors are due to :

1. Tanks badly constructed. The top of the tank is too large for accurate measurement, the bottom of the tank is flat and the discharge of the juice is not complete. The volume is not large enough to allow for sufficient time for air bubbles to be removed.
2. Adhesion of impurities on the brim of the overflow.
3. No counters or level indicators are used, etc. etc.

Measurement by volume under best conditions may be accurate to within ± 2o/o. Under local conditions it is doubtful whether an accuracy of ± 4o/o is obtained. Weighing of juice may be done to within 0.1 to 0.2% .

Imbibition Water

The correct weight of water must be obtained in order that the correct weight of bagasse may be deduced. Unless this is done the sucrose content of cane cannot be accurately determined and an exact control cannot be obtained.

Imbibition water is measured in one factory by a Lee recorder. In two factories, Kennedy meters are in use and in six factories automatic measuring tanks are used. The other factories do not weigh or measure the amount of water used and the weight of bagasse is calculated by an arbitrarily fixed factor. That factor is unfortunately not a constant quantity ; it varies from factory to factory and from year to year with the result that unreliable weight of bagasse is obtained.

Water meters are not generally reliable enough for the measuring of imbibition water. The accuracy of meters of the Venturi or V-notch type is affected by impurities in water due to deposits or clogging. Kennedy meters are of the displacement type, they are the best type but their accuracy should be checked often otherwise a long time may elapse before discovering that the meter has gone out of order due to leaks in pistons or packing.

Determination of weight of imbibition water by means of the Rey or Ménagé system may give more accurate results provided that proper closing of the valves, proper working of the mechansm and proper recording are observed. The temperature of the liquid should however be recorded by means of an automatic continuous recorder, the inherent inconvenience of the determination of the weight of a liquid by cubic measurement is not so great as in the case of juice as no solid particles, no air or froth are present. The International Society of Sugarcane Technologists recommends the weighing of imbibition water.

The weighing of sugar is generally effected by means of Fairbanks scales. 14 factories have automatic scales. The scales give better results with white sugar than with raws due to the sticky nature of raw sugar. The weighing of sugar is in general not carried out with sufficient accuracy ; it is done too quickly for precise results. The extraction worked out according to weights obtained at th factory and at the docks show differences which lie between + 0.23 and — 0.12. Only 50 per cent of the factories show differences in extraction which lie between + 0.03 and — 0.03. The weighing in wagons as the sugar leaves the factory would give better results.

Molasses

This product is weighed in only three factories. Scales of the platform weighing type are used, tare weights are taken after each weighing. It is often proudly stated that the Clerget purity of molasses in a certain factory is as low as 35 or even less. This figure by itself is no indication of good work. If the weight of molasses is unknown the control of the boiling house is incomplete and the undetermined losses — especially sometimes large losses through inversion — cannot be detected and controlled.

Scums

Scums are weighed in only seven factories. The scums are dumped in wagons and the wagons weighed on cane weighing machines. The weight of scums in other factories is generally assumed to be 1.50 to 1.70 c/o cane. Though the difference between the true weight which varies between 1.25 and 2.50 c/o cane, and the assumed weight only slightly affects sucrose balance, scums should be weighed in all cases.

In conclusion, it might be said that the importance of obtaining correct weights of cane is generally recognised in Mauritius. Enough attention is however not paid to the determination of the weight of mixed juice, imbibition water and sugar. Unless the correct weights of those materials are ascertained, it is not possible to know the correct sucrose content of cane and the loss of sugar incurred in the factory.

WEIGHING PRACTICE IN THE NATAL AND ZULULAND SUGAR FACTORIES

With the exception of perhaps cane weighing the importance of obtaining correct weights is much more fully recognised in the South African Sugar Industry than in Mauritius. Proper attention is paid to the correct determination of the weight of sucrose purchased and of sugar sold, factories are well equipped with scales and good control is maintained. Weighing scales have to be of a type approved by the Government Assize Department the sensitivity of the scales has to conform to the Weights and Measures Act. The South African Scale Company, in return for a certain agreed annual fee, yearly overhaul the scales and periodically (about one every three months) check their accuracy. The South African Scale Company employ a staff of experts and have a well equipped workshop in Durban for carrying out repairs to scales. The overhauling is done prior to the crop and when the scales have been put in first class condition Officers of the Assize Department come on the scene with a view to ascertaining whether they conform to the degree of accuracy laid down in the Weights and Measures Act. Furthormore, during the crop the scales are frequently tested by the factory authorities and the cane testing service has a constant eye on weighing operations.

Cane

The same type of platform weighing machine as used in Mauritius is in service. Railway weighbridges have a 36' platform, 80 ton capacity. Road or lorry weighbridges have a platform of 30' x 10 and Tram weighbridges vary from 6' long to 20' long. The sensitivity as laid down in the Weights and Measures Act, works out to .04 o/o for the smaller type and .02 o/o for the bigger ones. Avery scales are used practically everywhere. In a number of cases the weighing machine is fitted with dial scale with visual reading, this is an improvement as it facilitates the checking of the

weight found. A few factories are using platform weighbridges (Avery) fitted with Dial Scales and electrically operated ticket printing headword. The recording apparatus prints on ticket and control tape, and the following records can be printed :

(a) Weight only.
(b) Weight and consecutive number.
(c) Weight, consecutive number and one head-set code letter or figure.
(d) Weight and three hand-set code letters or figures or weight and date (hand-set).

Mistakes in writing down the weight are eliminated. The recorder prints the correct weight as indicated on the dial. The possibility of fraud in recording weights is also eliminated, printing is possible only when the weighing printer is at rest. This ensures that only correct weight of the load can be recorded. Several factories are now negotiating the purchase of Avery weighbridges fitted with electrically operated ticket printing headword. Most factories have cane weighbridges only at the factory yard where all canes are weighed ; the planters seldom check the weighing and have confidence in the weigher. The canes are generally manipulated soon after being weighed. At one factory the weighbridge and cane carrier are under one roof,— an arrangement which offers good guarantee, especially in humid climates, for the correct determination of weight of bagasse.

Mixed Juice and Imbibition Water

In terms of the Sugar Agreement, juice must be weighed and water must be either weighed or measured by a type of scale or measuring apparatus approved by the Assize Department. In all the factories, however, both juice and water are weighed. Platform weighing scales of the type used in Mauritius are not accepted, Howe, Maxwell-Boulogne and Simpson scales are in use. In one or two cases, the Leinert liquid meter is also used for weighing water. The Howe scale has up to now been in general use but the present trend is to introduce automatic weighers. Two factories are equipped with Simpsons for weighing juice, a third one, which was using that scale, has now closed down. The Maxwell-Boulogne is to be seen in most of the factories.

Howe Scale

The Howe Scale gives very accurate weight, unfortunately it is not automatic and the results obtained depend on the conscientiousness of the operator (see Appendix). Under the Sugar Agreement, the weight must be stamped on sequence numbered tickets. Automatic counters as well as Bristol recorders are used to check the work of the operator. Bristol recorders indicate at each operation the level at which the tank is filled and whether it is properly emptied. Comparison of the dial chart with the weight tickets offers a good means of checking. The tare is determined before each weighing and the weight stamped on the card. I

have seen cases where the tare has varied in a few hours by as much as 30 lbs, due mainly to accumulation of insoluble matters in the tank.

The Maxwell-Boulogne Weigher

The Maxwell-Boulogne weigher (see Appendix), as well as the Simpson weigher, is automatic and does not require the presence of an attendant. The general opinion in South Africa favours the Maxwell-Boulogne scale (new vertical type), a number of factories have recently ordered that type of scale which will be used in lieu of other scales and for weighing molasses.

The Simpson Scale.

The Simpson scale, as the Maxwell-Boulogne one, works on the over-balancing counterpoise system. There are two weigh tanks (see Appendix), when one tank is being weighed, the other one is being discharged. They are considered to be reliable and accurate for juice or water.

The Leinert Liquid Meter

The Leinert meter is actuated by dead weight of the liquid (see Appendix). It is simple in construction and is considered to be accurate enough for water, but is not recommended for juice. The liquid which remains in the tank at the end of each discharge is of constant volume but not of constant weight ; also the tank is suspended eccentrically and the impurities which collect in front of it have a large turning moment. The Leinert scale when used for a liquid of constant density containing no solid matters is accurate to within 0.5 o/o.

Scums

Scums are weighed in the same manner as in Mauritius. In certain factories the whole of the scums are weighed ; in other cases, a number of test wagons or tip barrows are weighed and the average weight found is multiplied by the number of loads.

Molasses

Molasses are only weighed in a minority of cases. Maxwell-Boulogne or Howe scales are used. Most technicians realize the importance of weighing molasses and steps are being taken to introduce more scales to that effect.

Sugar

The platform scale used in Mauritius, fitted only with a steelyard, has been discarded in South Africa as it has been found that too much

depends on the human " element ". Two types of scales are now used : the Avery Sacking Off Scale which weighs a pre-determined weight of sugar while the bag is being filled.

The amount to be weight, including tare of the sack, is set by means of counterpoise weights and steelyard poise. the bag is attached to the holder and the feed valve opened ; when the pointer reaches the zero point the valve is closed and the bag released. The second type is the pre-termined platform scale, it works on the same principle as the Sacking Off Scale but the bag is weighed on the platfofm. Those scales facilitate filling and check-weighing and enable the operator to handle a maximum of loads in a minimum of time.

Testing of Scales

In addition to the servicing done by the South African Scale Company and to the testing performed by the Assize Department about twice a month or even oftener, the scales in the factory are tested by the employee in charge. Howe scales are tested by means of dead weights. Automatic scales are tested by filling the weigh tank with water and by weighing a number of tips in a drum placed on a platform scale. In one case, a Howe scale is used. The average of the weights found is taken. Automatic weighers are generally guaranteed for a tolerance of 0 25o/o of the true weight In one case, tests made with a Simpson scale showed an accuracy of 0.13 o/o. An average of ten tests gave one Maxwell Boulogne Scale accurate to within 0.06 o/o.

Automatic Counters and Bristol Recorders

Automatic scales deliver a determined weight of juice at each weighing. For determining the weight of the liquid delivered during a certain period of time it is only necessary to know the number of tips during that period. That is done by means of automatic counters. As one counter might get out of action there are usually two counters fixed to each scale. In adition to counters, in most cases weighing scale are fitted with Bristol recorders.

Automatic scales for weighing water

When using automatic scales for water, it is necessary to fit in a device by which the inflow of water in the weigh tank may be regulated according to the amount of imbibition water used That may be done by fitting a valve on the supply type. The valve is worked by a float placed in the receiving tank at the bottom of the scale. When the level of the water rises, the valve is closed and when the level is low, it is fully opened.

Conclusions

One of the leading Sugar Technologists of Natal told me that it was only when accurate scales for weighing juice and water had been installed

in the factory under his control that he was able to have a good in sight of the losses incurred and that the installation of these machines had definitely led to better work and higher recovery. There are strong reasons why we should follow suit and derive the benefits of accurate control. I consequently strongly recommend that immediate steps be taken for the introduction of weighing scales for juice and water. The expenses incurred in that connection would be compensated in a short time by the bagging of more sugar following better control. Our Technologists are well alive to the necessity of better control and to the urgency of further progress so as to reduce cost of production. Automatic scales should be used, they are accurate and require no labour. The choice lies between the Maxwell-Boulogne scale of the vertical type which works on the tare weighing principle is robust, accurate, contains few moving parts, and the Simpson scale which also gives good results, the tanks are designed so that they retain a minimum amount of solid particles and ample time is given for complete discharge of juice. They have however to be cleaned at regular intervals. The question of price should also be one of the deciding factors concerning the choice between the two types. The price of Maxwell-Boulogne scales varies between about £ 400 for the 10-ton model to about £ 1000 for the 90-ton model. Unfortunately I have not been able to obtain quotations for the Simpson scale, but Messrs Gilbert Hammer the Durban Agents, have kindly requested the makers in U.K. to communicate all necessary information to the local agents. Maxwell-Boulogne weighers are made in the following sizes : 10, 30, 40, 60, 90, and 120 tons per hour ; Simpson weighers are made in three sizes : 40, 60 and 100 tons.

A certain number of our cane weighbridges are in poor mechanical condition and will have to be discarded in a near future. New machines with dial scales and electric recording should be ordered whenever possible. Weighing by means of those scales may be done quicker than with ordinary scales. They would be of special interest in the factory yard where a great number of vehicles are received daily. A source of electric supply is required to work the printing mechanism. The use of Avery sacking off scale or Avery pre-determined platform scale for weighing sugar would also help the industry to progress. So far as weighing of molasses is concerned the question might be considered after the installation of juice and water scales has been completed.

It would be highly beneficial to the industry if we had in Mauritius an organisation run on the same lines as the South African Scale Company for the carrying out of repairs and tests of all scales used in the Sugar Industry.

PART II

The use of The Oliver-Campbell Mud Filter in South Africa

Continuous and automatic or semi-automatic processing in industries

has many advantages over intermittent operations. Conditions prevailing at present in most sugar-producing countries are such that labour has to be cut down to a minimum The use of machines leads to increase of production, less sweat of man's brow and higher standard of living. In South Africa, continuous operation at the filter station has rapidly taken the place of intermittent plate and frame presses. In 1937, the first continuous filter was installed and at present 18 sugar factories out of 20 are equipped with that type of filter. All continuous filters are of the Oliver-Campbell patent, except in one factory where juice is clarified by means of carbonation process and where Mauss filters are used. It may definitely be stated that under conditions existing in South Africa it has been found advantageous to use automatic filters. The replacemant of the batch plate and frame presses by the Oliver-Campbell continuous filters has in fact been one of the most striking features in manufacturing methods of the Sugar Industry in the past ten years.

The advantages derived from Oliver-Campbell filters are :

1. Continuous operation.
2. Large saving in labour.
3. Low sucrose content of cake.
4. Elimination of filter cloths, repairs to cloths, cloth washing station.
5. Cleaner filter station.

Other advantages may be derived according to local conditions such as saving in chemicals, steam, less inversion, etc.

Continuous Operation

The filter consists essentially of a rotating drum covered with perforated copper or stainless steel plate with .02" diameter perforations and having a number of filtrate casings. The drum dips in the mud to be filtered and as it rotates, the vacuum which is maintained in the segments causes the mud to be deposited on the perforated plates in a thin cake. The juice filtered at first conditions a high percentage of mud but as the thickness of the insoluble matter deposited on the screen increases, a cleaner juice is obtained. There is a device for separating the turbid from the clear juice. The cake is washed with water as it emerges from the bath and is eventually discharged in a hopper. Provided that certain precautions are taken, the work is continuous and no difficulties of filtration are encountered Mr. O. d'Hotman de Villiers in his communication to the Sugar Industry Reserve Fund expressed some doubts as to the advisability of having only one filter in a factory. Several factories in South Africa have only one filter which has now been working for a number of years and no serious breakdown has ever occurred. From what I have been able to see, the Oliver-Campbell filter is a very dependable plant. Provided that necessary spare parts are kept in stock and that the mud tanks are of sufficient capacity to allow for short stoppages, there should be no fear of having to stop the mills due to failure at the filter station.

Conditions necessary to ensure efficient work are :

(a) Viscosity of juice diminishes with a rise in temperature, great importance is given to the temperature at which the muds are filtered, a temperature of 90-95 °C seems to give best results. If the temperature is allowed to drop the rate of filtration is retarded and the under side of the screen may become coated with scale due probably to cane wax. To remove this is a tedious operation as it is necessary to take the screen off and brush it.

(b) The muds must be maintained at the proper density : when too thick, they are diluted by filtered or turbid juice and when too thin, bagacillo is added. The rate of filtration depends to a large extent on the ratio of the cane trash to dirt in the muds : the trash on account of its coarse structure helps filtration and the dirt retards filtration. In South Africa, in all cases bagacillo is added to the muds, the proportion varies considerably according to factories from 0.4 to 1.5 % on cane. The size of the particles used is also of great importance. Large particles help filtration but allow a high proportion of mud to pass through the screen and render the washing difficult. Small particles increase the mud retention figure but decrease rate of filtration. Screens of 1/16" to 1/8" holes are commonly used. The general opinion is that better results would be obtained with bagacillo of smaller size. Bagacillo is usually obtained by placing a screen (sometimes a shaking screen) on the last mill or on the furnace chute, it is collected through ducts by means of vacuum created by a fan and is discharged through a cyclone separator to a tank where it is mixed with the muds. Bagacillo kept for any length of time should not be used at the filters, it makes a poor filtering medium.

Oliver-Campbell filters give best results with continuous clarifiers which give a mud of porridge-like consistency containing a high percentage of insoluble solids. Mud from intermittent clarifiers is much more liquid, containing 3 to 5 per cent insoluble solids. Consequently, when working with intermittent clarifiers much more filtering area is required and more bagacillo has to be added to the muds. A few factories in South Africa, however, are equipped with intermittent clarifiers and continuous fiilters.

Drum Speed

In the South African sugar factories the speed of the drum of Oliver-Campbell filters varies from 12 to 25 revolutions per hour and is usually governed by the amount of mud to be treated. The operators are of opinion that a clearer juice would be obtained with slower speed but the capacity of the filters is in general too small to make that possible.

Size of Filter Required

In South Africa, difficulties have always been experienced in filtering muds due to their refractory nature ; canes, especially after rains, are

dirty with adhering clay and mud. When using Plate and Frame presses, 100 square feet or more filtering area per ton cane hour are required against 50 or less in Mauritius. In South Africa 5.5 to 8.5 square feet filtering area per ton cane hour are required when using Oliver-Campbell filters. That figure would be lower in Mauritius where muds are easily filtered and the amount on cane is lower.

Saving in Labour

One operator per shift at the filter is sufficient. The only duty which the operator has to perform is to see that the temperature of the mud is kept at the desired point, that the feed tank is kept filled with mud of the proper density and that sufficient amount of wash water is applied. With the Plate and Frame presses the biggest factories in South Africa used to employ as much as 20 men and 20 boys per shift. The use of Oliver-Campbell filters has consequently resulted in a considerable saving of labour.

Low Sucrose content of Cake

By using a relatively high amount of water, the sucrose in scums may be brought to a very low figure (0.1 o/o). A high amount of water however causes important re-dissolution of impurities resulting in poor recovery. Under local conditions, the use of a relatively small amount of water (5 o/o on cane or less) with a view to obtaining a cake of about 1% sucrose content would save fuel and minimise re-dissolution of impurities. Sucrose content of cake in South African factories fitted with Oliver-Campbell filters varies from 0.2 to 1.0 o/o with an average of about 0.55. Average weight of scums o/o cane is slightly over 5.0. In Mauritius the average weight of scums o/o cane is 1.8 with a sucrose content of 8.0 o/o. With Oliver-Campbell filters the weight of scums % cane would be about 4.0 o/o; assuming a sugar content of 1.0 o/o, the sucrose in scum o/o cane which is at present 0.144 would be reduced to 0.04.

Recovery of Sugar

What is the proportion of the sugar recovered at the filter which is actually bagged? This is a very debatable point on which I have not been able to gain any definite information in South Africa. Supporters of O. C. filters say a high proportion, others are not so enthusiastic and in support of their opinion put forward the fact that during the washing process a high amount of colloids in the cake is returned to processing. In certain cases, it has been observed that the use of O. C. filters has resulted in a higher amount of molasses o/o cane. In 1941, a committee presented a progress report on the working of the O.C. filters at the 15th Congress of the South African Sugar Technologists' Association. The discussion which followed showed that more detailed information was

required before definite conclusions could be arrived at on the merits of the O. C. filters. It was decided to appoint a full time technologist who would investigate the problems connected with O. C. filters. Unfortunately that has not been done.

I was told by an ex-student of the Mauritius Agricultural College, who is now a promising chemist in Natal, that the O. C. filter is a splendid machine which does the work, but the sucrose recovered at the filter is never found again. All the same, he is of opinion that the advantages are such that all our big factories should be equipped with O. C. filters. Information from other sources seems to indicate that O. C. filters have brought an increase of recovery between 0.5 and 1.0 o/o. My personal opinion based on all that I have heard and taking into consideration local conditions is that about 75 o/o of the sucrose recovered at the filter should be bagged, provided that the sucrose content of the cake is not brought down to a too low figure. The drop in purity from clarified juice to P. & F. P. juice is at present between 1.0 and 2.0 in Mauritius. With O. C. filters the drop would probably be 2.0 to 3.0

Amount of Water Used

The amount of wash water used varies considerably. According to information obtained, it would seem that 6 o/o on cane is sufficient to give a cake of reasonably low sucrose content. In South Africa, it was customary to wash the muds treated in P. & F. presses with a large amount of water and O. C. filters have brought a saving in steam. In Mauritius, installation of continuous filters would increase the demand of steam as at present the muds are not washed. The amount of extra steam required in that connection, reckoning on 5 o/o of wash water on cane and taking into consideration the amount of water which remains in the cake, would correspond to about 2 kilogs of wood per ton of cane. Factories where steam produced is just sufficient to meet requirements would have to account for this expenditure. Furthermore, the bagacillo required at the filters is lost as fuel, taking into consideration the dry matter content and nature of our muds 0.3 to 0.5 o/o of bagacillo on cane should be sufficient as filter aid. Assuming that bagacillo produces only half as much steam as bagasse, that amount would represent about 1 kilog of wood per ton of cane.

Quality of Work

Intermittent filters using cloth are to be preferred to the O. C. filters when a clear filtrate devoid of solid particles is required. The quality of sugar made depends, amongst other factors, on the absence of all insoluble matter, filtration under ideal conditions is only necessary in the manufacture of white sugar. The first filtrate from the O. C. filters is dirty as the openings of the screen are not small enough to retain the mud. The mud which is in a fine state of division is retained by a support of coarse struc-

ture (bagacillo) and filtration becomes more efficient when a certain amount of mud has been deposited ; the filtrate obtained is then clearer. As the drum rotates and the thickness of the cake increases, the pores of the filtering medium tend to clog and the rate of filtration is diminished. In South African sugar factories, the second portion of the juice (about 60 o/o of the total) which is filtered is not clear enough to be sent to the evaporators, it is together with the first filtrate returned to the head of the process into raw juice. In certain cases, the turbid juice is returned to the sulphur tower and the clear juice to the clarifier. The total amount of juice (containing as much as 40 o/o of the mud) returned to the process amounts to 20.25 o/o mixed juice. That means that increased capacity of pumps, juice heaters and clarifiers are required. The evaporator has also to deal with an extra burden of work depending on the amount of wash water used. The first turbid juice may be returned to the mud feed tank provided that a high percentage of bagacillo is used (6 to 7 o/o of suspended solids in settlings). From what I have seen in South Africa, the O. C. F. acts as a mud eliminator rather than as a filter, part of the mud is eliminated in the filter and the difference is separated in the clarifier and is sent back to the filter. In Mauritius, in view of the high filtrability rates and low quantities of scums, it might be possible in the manufacture of raws and by using large filtering area, low speed and fine bagacillo to send the second filtrate direct to the evaporator. That would be of a decided advantage as recirculation of muds would be avoided.

Recirculation of turbid juices dœs not appeal to me as it dœs not help clarification. Cane muds are very unstable and should be eliminated as quickly as possible. If it is not possible to obtain juices clear enough to be sent direct to the evaporator, I would recommend treating them separately, with phosphoric acid and lime if necessary, in a small continuous clarifier.

The possibility of using continuous filters fitted with cloth should also be considered. The nature of the muds in South Africa makes filtering through cloth in continuous filters very difficult but here the problem might be different. In that connection I have obtained a small hand filter from Messrs Patrick Murray (Pty) Ltd. of Durban, the agents for Mauss filters. The data obtained on filtration tests carried out locally will be communicated to Messrs Patrick Murray who might then be in a position to give an opinion.

Repairs

I have heard the word " important " from one operator and the phrase " quite a good deal " from another. I have also been told that with the experience gained in South Africa, it is now possible to cut down repairs to an important extent. The makers are now supplying plants more suitable to resist corrosion under local conditions. Here I may reproduce the following from the report of the Filtration Committee already mentioned.

" The overhaul of the plant has in some instances provided big pro-

blems. Corrosion of essential parts, excessive wear and tear on fittings, heavy depreciation on piping , etc., are the common experience.

" Abrasion in the bagacillo supply pipe, in the fan itself and in the cyclone, necessitating the fitting of rubber padding, the difficulties of getting rid of the sand in the trough and generally a more rapid and efficient method of cleaning to mention but a few, are matters of vital importance and all make up quite a respectable contra account to the gains associated with the installation of the Oliver-Campbell filter. "

It has been difficult to obtain exact information concerning annual cost of repairs. Some factories have only recently installed O. C. F., others do not keep separate records for repairs of the filter station.

The intensity of corrosion varies with local conditions. The copper tubes connecting the drum segments to the heads, which cost about £ 200 per set (including fitting) have had to be renewed in certain cases after three or four years. The ducts used for collecting bagacillo when made of light material have to be renewed after a few years ; some factories are using steel pipes with good results. The cyclone separator also wears rapidly, it lasts longer when rubber lined. The fan in certain cases has to be renewed every year, it is now made of special metal which gives better service.

Repairs of the filter press station in Mauritius are a relatively small item. There is no doubt that repairs to continuous filters would be a bigger item ; it would however be much less than in South Africa where excessive wear is due mainly to the use of SO_2 and to the abrasive action of dirt. It is difficult to give any exact figure but for our average factory, the sum of Rs. 2,000 to Rs. 2,500 per annum should not be exceeded.

Life of Screen

The life of a set of copper screens in South Africa may be taken as one year (a crop o 250,000 tons of cane). Under local conditions, copper screens would last probably three years. Steel screens last about three times longer but would probably be of no special advantage in Mauritius. The fitting of these screens requires about 150 man-hours, copper screens are more quickly fitted.

Amortization

The life of an O. C. Filter may be taken as twenty-five years.

Use of cake from O. C. F. as Fertilizer

Mr G. C. Dymonds, Chief Chemist of Darnall, has pointed out to me that retardation of plant growth follows the application of cakes containing

bagacillo, due to the decomposition of the fibre particles which withdraw nitrogen from the soil. When decomposition has been completed, plant growth is favoured. Mr. Dymonds is of opinion that scums from O. C. F. should be used in the making of compost.

Conclusions

It may definitely be stated that Oliver-Campbell filters have a number of uncontestable advantages — automatic operation combined with saving in labour, saving in filter cloth, low pol. of cake and cleaner process. On the other hand, O. C. filters are expensive plants, comprising vacuum pump, filtrate pumps, condenser, moisture trap, spray trap, filtrate receivers, tanks, sifter fan for handling bagacillo, air ducts, cyclone air-separator, feed mixer, piping, etc. Overhauling and repairs under local conditions would be more expensive than with plate and frame presses. In South Africa, the average quantity of cane crushed annually per factory amounts to about 220,000 tons ; the corresponding figure in Mauritius is 85,000 tons. In South Africa, steam is in general produced under conditions as efficient as possible, its utilization is done under economical oonditions and adequate machines exist for good performance (due consideration being paid to quality of cane and refractory nature of juices). In Mauritius, the position is often different. Most of the stations need improvement. Considerable capital expenditure is necessary for the purchase of adequate modern machinery and most of our factories (specially the smaller ones) are unable to afford heavy capital outlays. That has been done in many cases in South Africa by concentration of milling — one factory wlll in a near future manipulate 200 tons of canes per hour and will become the biggest sugar factory in the British Empire. The point to consider in Mauritius is which of the stations should first receive attention. It is not possible to give an opinion which would be applicable in all cases. It is for each miller to consider his own case. The installation of a continuous clarifier should, in my opinion, precede that of an O. C. F. Bach and Dorr clarifiers are both used with good results in South Africa. In cases where extra fuel would be required for processing with O. C. filters, the possibilities of improving steam production and/or reducing steam consumption should be considered in the first instance. So far as financial comparison of the O. C. F. versus the P. & F. P. is concerned, comparative estimate of initial cost, capital and operating charges is necessary to enable a decision to be arrived at. Expenditure on new machines must be justified by increase of revenue due to additional amount of sugar bagged, unless the expenditure has to be made on account of real shortage of labour. Cost of O. C. F. plants (including estimate costs of installation and cost of screens) may be obtained from the local agents (Messrs Adam & Co.). The information given above will enable annual charges for the O. C. F. to be worked out with a fair degree of accuracy. For the P. & F. P. each miller should take into consideration the cost in his own factory.

	O. C. F.	P. & F.
Annual Charges		
Amortization on cost of plant and installation		
Average interest on above ...		
Repairs		
Screen O.C.		
Cloth P. & F.		
Labour		
Extra fuel O. C. (if any) ...		
Sugar loss in cake		
Total annual cost of operation ...		

$$\text{Sugar loss in cake} = \frac{X \times \text{Scums \% Cane} \times \text{Sucrose \% Scums} \times R \times Z}{100 \times 100 \times Y}$$

where X = Tons cane manipulated per crop
R = Recovery
Z = Value of one ton sugar
Y = Pol. of Sugar.

Note From the value of the sugar must be deducted cost of manufacture, bagging and transport of sugar to town.

PART III

Rock Breakers on the Transvaal Gold Mines

There is a very great number of rock breakers in use on the Transvaal rands. Practically all the existing machines have been tried and only the best ones are now in use, About 7,000 tons of stones are crushed per hour and as operation started some 60 years ago, considerable experience has been gained in stone crushing. The stones, I must say, are not basalt but quartzite which is a softer material weighing about 110 lbs per cu. ft. The mines' engineers are however of the unanimous opinion that the hardest stones cannot break the best stone crushers in use on the mines.

Rock breaking is carried out in four steps :

1. Blasting.
2. Jaw crushers.
3. Gyratory crushers.
4. Tube mills.

Blasting

Stones of a maximum size of 20"-24" are generally fed to jaw crushers. Big stones are drilled by means of portable air compressors and the stones are blasted with the help of explosives. The bits are detachable and fresh bits fitted to the jumper when the edges of the working bit are worn out. When it is necessary to drill a deep hole, a slightly bigger bit is used at the start and the standard one for the finish.

I have discussed the question of blasting boulders with the explosives experts of the African Explosives & Industries, Ltd. Their opinion is that big basalt boulders may be blasted by means of plastering or mud capping. The explosive is packed closely against the surface, preferably at a spot which will improve the confinement of the explosive, the charge is plasted with clay or mud to a height of 6 to 8" and fired. The explosive experts, however, do not recommend this method, their objection being that a large amount of explosive is required and the results are often negative. They are of opinion that the best way of blasting boulders is to drill holes in them, charge the holes with explosive cartridges, necessary detonators and fuses and to fire. The method implies labour and the running of a drilling machine but in the end is more economical. A very good way of preventing stones which are being blasted from being flown in all directions is to use a net built up with wire forming 6" squares. The corners of the net are kept down with stones.

Hard rock is generally blasted by means of gelatinous explosives. Owing to their high density and power, gelatinous explosives are more suitable than dynamite for hard rocks. Ammon Gelignites 40 o/o, 50 o/o, 60 o/o are the forms more commonly used. Ammon Gelignite 74 o/o and blasting gelatine (the strongest commercial blasting explosive made, containing 92 o/o Nitroglycerine and 8 o/o nitrocotton) are used for the blasting of the strongest rocks.

One of the rock-boring machines most widely used in the mines is the Holman air compressor. I have approached Messrs Holman Brothers of Geneva House, Johannesburg, who have most willingly given the following information, which will enable the selection of the type of machine most suitable for any particular job and the working out of cost of operation.

Four Diesel engine driven models of portable air compressors are available. They are mounted on higher flat tread wheels, solid rubber-tyred wheels or pneumatic-tyred wheels.

Model	T 13 D	T 20 D	T 25 D	T 36 D
Price in South Africa	£ 950	£ 1335	£ 1645	£ 2048
B.H.P. hr. rating H.P.	32.5	45.8	58.5	88
Consumption				
Fuel oil-engine gals/hr	1.31	2.2	2.4	3.6
Lub. oil-engine Pts/B.H.P. ...	0.005	0.005	0.005	0.006
Lub. oil compressor hrs/gal. ...	240	240	150	150
Air delivered at 100 lbs/sq. in...	105	170	207	305

The Silver Dart throttle blowing type handrill gives first class service. It costs in South Africa £ 55 and takes 70 cu. ft of air/minute at 80 lbs/sq". 1¼ to 1⅜ diam holes may be bored. In basalt, the boring speed would probably be 4 to 6" per minute. The handrill is fitted with a blowing device for cleaning out sludge or chippings. Tungsten Carbide tipped bits give excellent results for hard rocks.

Jaw Crushers

Jaw crushers are universally used on the rands for coarse crushing. In general, stones of a maximum size of 20" are fed to this type of crusher. The bigger machines can take stones of 4' or more but they are of a very heavy type and would not be suitable under local conditions. About 35 o/o of the ore coming from the shafts go to the jaw crushers, the difference is of a size small enough to be fed directly to the gyratory machines. On one of the mines I have seen a jaw crusher in operation which had been in service for 35 years. It was reducing 40 to 45 tons of stones per hour from 18-20" to 5". The driving unit was an electric motor (the form of power used on all the rands) of 50-60 H.P. Crushers on the mines work for 6 days a week without stop.

The type of jaw crushers more generally used is the Hadfield and the Allis-Chalmers. Both types are very reliable and give good results. The crusher consists essentially of a stationary jaw and of a swinging jaw operated by an eccentric shaft through a system of toggles and pitman. The machine works at about 250 revolutions per minute, at each revolution the stones receive an impact and are reduced in size, they then fall downward, where the distance between the stationary jaw and the swinging jaw is smaller, and receive another impact. The crushing goes on until the particles are small enough to pass out at the bottom of the machine. The size of the particles delivered may be varied by adjusting the distance between the jaws at the bottom.

Cost of Operation

The running cost of crushing (including maintenance, oil and driving power) amounts to a fraction of a penny per ton. Electric power is very cheap in the Transvaal and amounts to about 0.1d per ton of stone crushed.

Amortization is calculated on twenty years. These figures would not be applicable to Mauritius where the material is harder and more abrasive, where the amount are to be treated would be less (on an average about 200 tons of ore are crushed per hour on a mine) and where the cost of fuel would be much higher.

Gyration Crushers

Stones of 4.5" size are treated by fine breakers of the gyratory type. Larger particles up to 12" or more may be fed but the product delivered will be of a coarser nature. Particles having a one-way dimension not larger than 3/16" to ¼" may be obtained when a bowl of a fine type is fitted. The normal practice is to reduce the stones to about ¼" size with a feed opening of about 4". On one of the mines I have seen a Symons cone crusher driven by a 100 H.P. motor crush 120 tons of stones per hour from 4-5" to 1/4". The running cost of fine crushing on that rand (worked out on an average of three years including maintenance, oil and power but excluding amortization) amounted to 1.6d per ton.

Roll crushers have not met with great success on the mines. When compared to gyration machines, running cost and maintenance are considered to be high and output low.

Symons and Allis-Chalmers are the gyratory crushers in great favour on the mines. The newhouse crusher (Allis-Chalmers) is rendering good service but I was told that the eccentric bearing which is bushed with a special bearing metal requires very fine adjustment and a small wear diminishes the crushing rate of the machine. Newhouse crushers are suspended from the crushing plant structure by means of three cables and would not be suitable for a portable plant.

Gyratory breakers briefly work on the following principle : The stones are crushed by small powerful strokes which they receive whilst passing between the stationary crushing surface and the crushing head which is gyrated by means of an eccentric driven through gears and a countershaft. The machine revolves at 400 to 600 revs. per minute. The stones on entering the crushing cavity receive an impact by the head as it moves to the closed side, the broken particles fall vertically towards the head, and when the head moves again to the closed side the particles of stone receive a second impact. The process goes on until the particles are small enough to be discharged at the bottom of the machine. The mantle and the bowl liner are of manganese steel. The bowl may be raised or lowered so as to increase or decrease the opening of the cavity and hence obtain larger or smaller particles.

Only stationary machines are used on the mines. The difficulty was to find a suitable portable plant mounted on wheeled trucks which could be moved from place to place so as to meet local requirements. Crushers may of course be purchased and erected on platforms mounted on rubber-tyred

or pneumatic-tyred wheels but I would not advise this course as we might have to pay dearly our experience.

I have discussed the question at length with Mr. G. Bateman, the Manager of Bateman, Ltd. in South Africa Mr. Bateman is not very encouraging. He his not of opinion that portable Allis Chalmers crushers of a type suitable to meet our requirements could be supplied. He advised me to contact Messrs. Edgar Allen & Co. of Garlick House, Johannesburg, who are manufacturers of jaw crushers and mill crushers. That was done, and the local firm has referred the matter to headquarters in England who will probably communicate with me in due course.

I have met with more success with Messrs. Fraser and Chalmers of Culliiam Building, Johannesburg, the agents of Hadfield jaw crushers and Symons cone crushers, two machines of high outstanding feature giving unfailing service on the mines. After discussion, taking into consideration local requirements and the necessity of having an easily portable plant, Messrs Fraser & Chalmers have offered the plant. Quotations and details of the proposal will be fowarded shortly. I have communicated the proposed scheme to an experience mine engineer for an opinion and his report is a short one "accept it, you can't go wrong". It will be noted that it is proposed to feed stones of 6" maximum size to the first crusher, the suggestion is that stones after being blasted would be reduced to that size by hand. If desired, the size of the grizzly may be increased so as to take pieces of stone up to about 10' size. A 24" x 13" jaw crusher could also be supplied to take pieces up to 13". This crusher would, however, have a capacity greater than the second crusher (gyratory) and would reduce the portability of the plant (a 24" x 13" jaw crusher weighs about 12 tons).

Whilst in Durban my attention has been called to the fact that Messrs. W. D. Kyle (Pty) Ltd. of Maydon Road, Durban, were suppliers of portable crushing outfits for road making and other purposes. Those plants are being used with success in Natal, Transvaal, Lourenzo Marques, Rhodesia, Belgian Congo, etc. I have discussed our problem with one of the Directors (Mr. A. J. Humfryes) and the Engineer (Mr. Kraiser) of Messrs. W. D. Kyle. A layout of the plant suggested and approximate price will be submitted shortly.

A 3-stage portable crushing, screening and loading plant is proposed.

(a) *Primary Crushing Unit :*

One 24" × 13" Pegson Roller Bearing Double Toggle Jaw Crusher, mounted on a carriage.
Maximum feed size 13". Discharge setting 4".
The crusher will receive its feed from a short conveyor belt which is extended into a pit allowing lorry or wagon discharge to the ground.

(b) *Secondary Crushing Unit :*

One 28" Telsmith Intercone Reduction Crusher, mounted on a carriage,

and receiving its feed from the small conveyor belt connected to the Primary Unit.

Feed size minus 4". Discharge setting $1\frac{1}{2}$".

(c) *Tertiary Crushing Unit* :

One 24" Telsmith Gyrasphere Fines Crusher, mounted on a carriage.

Feed size minus $1\frac{1}{2}$". Discharge setting minus $\frac{1}{4}$".

A Bucket Elevator receiving the minus $1\frac{1}{2}$ material from the Intercone crusher. will lift it up to a Vibrating Screen which is mounted on a portable small bin with a capacity of approximately 20 tons. This will facilitate loading on the wagons or lorries.

All the material minus 1/4" will fall into the bin, whereas the oversize will be fed to a chute into the Tertiary Crusher. The crushed product will again be lifted up by an elevator into the loading bin.

APPENDIX

A short description of the juice and water scales in use in South Afvica is given hereunder. Fore more complete details the reader is refered to the descriptive booklets supplied by the Agents.

How Scale

The scale consists of two weighing tanks counterbalanced through a system of levers and knife-edges forming two beam scales. The scale is fitted with Howe recording beams by means of which a printed record may be obtained of each weighing. A control lever which is worked by the attendant ensures that only one tank is filled or discharged at a time. When one tank is filled the juice is allowed to run into the other tank, the balance of the weighbeam of the first tank ts adjusted and the weight is stamped on a card. The juice in the tank is then discharged. When the second tank is filled the juice is directed to the first tank (after closing of the discharge valves) which is by that time empty and the second tank is weighed. The Howe scale is very accurate when the attendant dœs his work conscientiously.

Maxwell-Boulogne Weigher

There are two types of Maxwell-Boulogne weighers,— the horizontal and the vertical types. The latter type is to be preferred as it works more smoothly and without shock. The Maxwell-Boulogne scale is accurate, simple in action, very dependable and requires no attention. It has the advantage over most other scales of having a device (the tare-weighing principle) for the automatic correction of impurities which remain in the weigh tank after each weighing. The operation of the weigher is due to force of gravity.

The scale works on the overbalancing counterpoise system. there are one feed tank and one weigh tank. When the feed valve of the supply tank is opened the liquid from the supply tank flows into the weigh tank, a hinged rod connects the feed valve of the supply tank to the discharge valve of the weigh tank, there is a serrated shield which is held open by the weight of the float. When the weigh tank has received almost the desired weight the float comes into operation, due to the rising of the liquid in the weigh tank, and lowers the shield around the feed valve. This allows only a small flow of the liquid to pass throug the valve to the weigh tank until the desired weight has been obtained, then the total weight of the weigh tank and the contained liquid overcome the counter-weight, the weigh tank sits down closing the feed valve and opening the discharge valve. The weigh tank empties until the liquid is discharged, except that held back by a baffle plate which passes in a light flow through a small outlet in the baffle before leaving the tank. When the tank reaches the tare weight, the counter-weight causes the weigh-beam to tilt, the weigh tank is raised to the filling position, closing the discharge valve and opening the feed valve. An automatic counter is used to record the number of tilts which should not exceed 30 per hour for the large machines and 40 for the smaller ones.

Simpson Scale

The liquid is intermiteently charged through a hopper into each of the two weighing tanks ; as soon as equilibrium with the counter-weight has been reached the tank sinks causing a rod to tumble over a double lever (provided with a tube partially filled with mercury, for quick movement) which is connected to a baffle in the hopper, the juice is thus diverted to the other tank. For starting the movement an excess force is required, an excess of liquid is allowed to enter the tank so as to initiate the tilting performance. The excess liquid is released by a surplus valve until the tank start to rise again. When true equilibrium has been reached, a lever works a set screw releasing the surplus valve rod and closing the surplus valve. By the same action the hammer is made to tumble over opening the discharge valve. When the discharge has been completed the tank goes back to its original position and the discharge valve is closed. Regular cleaning of the tanks is necessary for accurate results as the scale does not work on the tare weighing principle.

The Leinert Meter

The meter consists of two tanks of equal size each swinging independently on knife edges, each tank is filled automatically and alternately. The tanks are normally kept in a horizontal position by means of adjustable weights. When the weight of the liquid entering the tank overcomes the counter-weight, the tank tilts forward and the liquid is syphoned out. When the level of the liquid has fallen sufficiently the tank falls back to its horizontal position, the syphon action continuing until most of the liquid has been discharged.

MAURITIUS HEMP PRODUCERS' SYNDICATE

Talk given by Mr. P. W. Lees at a meeting held on the 4th December 1947.

Your Excellency, Mr. Chairman, Gentlemen,

Your chairman asked me to come here to-day in order to give you some of my impressions and conclusions with regard to your fibre industry in Mauritius.

I have been here about 5 weeks and during that time I have visited almost every fibre factory in the island with a view to obtaining as clear a picture as possible of the industry as it stands at present.

I found that in general, the state of your machinery is bad; this is no doubt; in great measure, due to the lack of good materials available in the island and the consequent use of second hand articles and make shift material. With one or two exceptions, factories do not appear to have developed a great deal in the course of a long period of years, either in the layout or in improvements to plant.

I come now to the capacity of the machines at present in running order. I find that there are 81 Raspador units and 5 automatic units. Reducing these automatic units to equivalent Raspador capacity we get 101 Raspador units. The output claimed for a Raspador unit is 1½ metric tons of dry fibre per month of 25 days. This would give us a total of 150 tons per month for the island. Basing this on an 8 month year to allow for the sugar crop, we get 1,200 tons per annum as a potential output from existing machines.

The requirements of the sack factory at the present moment are stated to be 750 tons per annum for a single shift, or 1,200 tons for a double shift, to give a total of 900,000 bags. It will be seen then, that the bag factory as it stands now could be kept in full production by the fibre producing machines at present available but that any increases in plant at the sack factory would entail a demand for an increased output by fibre producers.

The existing machinery has many disadvantages. Although some automatic machines have been manufactured, in the main, fibre producers seem to have preferred to stick to the Raspador. Possibly it is the old idea that it is better to deal with the devil you know, than to deal with the devil you don't know and the Raspador certainly is a devilish machine.

Many factories suffer from lack of power, sometimes due to the state of their engines which are getting rather ancient.

The labour situation is not good The production of fibre is always a dirty and unpleasant job ; this is particularly true where Raspadors are used. The skilled "gratteur" is hard to find and when found is rather unreliable. Also the prevailing system of payment by green fibre is not an inducement to work. It would seem that the worse a "gratteur" decorticates the leaf, the heavier the green fibre will be and the more he gets paid or the less work he has to do to earn his pay.

Lack of water, is in my opinion, one of the worst handicaps that fibre producers have to sustain. Some factories have a complete shortage of water and many have a very indifferent supply.

So much for *the industry as it stands now.*

The future possible requirements of the sack factory are said to be 5,000 tons per annum in order to manufacture 6 million bags to accomodate the whole sugar crop. I understand that there is a possibility of increasing the sugar crop still further, so that still more fibre would be required. In any case, I personally feel sure that were you to attain the rehabilitation of the fibre industry the production of 5,000 tons per annum, you yourselves would not be content to stop at that if you could produce more. I am of the opinion that the rahabilitation of the fibre industry should be tackled in two phases, and here I would like to stress that this is purely my own personal opinion.

Firstly : To maintain a steady production of 1,200 tons per annum in order to keep the bag factory at full capacity, until such time as that factory is extended and its capacity enlarged. During this period, the cultivation of new areas of aloe should be entered into Increase of machinery in the sack factory would have to be based on the areas of leaf becoming available for decortication.

Secondly : To increase fibre output steadily up to 5,000 tons per annum.

This increased output would be gradual and would have a definite relation to the areas planted. A programme should be laid down which should make it possible to have factory facilities ready in good time for the leaf... When I say factory facilities, I include the sack factory as well as the actual fibre producing factories. With machinery deliveries as bad as they are at present this planning method becomes almost compulsory. Again, I make the point that everything depends upon and is in relation to the areas planted both on a time and also on a quantity basis.

The machinery necessary for fibre production for the first phase is required quickly if the existing raspadors are not going to be used.

The installation of 12 units of ½ ton daily output of dry fibre for 200 working days per annum, will give the required 1,200 tons.

The machine must have a simple feed and an efficient delivery. There does not appear to be any local objections to the practice of retting, in fact, most people that I have met here, approve of it. Personally I should like to see fibre well enough decorticated and washed as it comes from the machine to dispense with retting altogether.

However as there seems to be little objection to the practice, the decortication of the leaf need not be perfect during this first phase of development.

You have only one automatic machine in the island at the present time which will give ½ ton dry fibre per day. It is a costly machine, requires a lot of power, is very complicated and relies for semi skilled men for feeding : I do not think that this machine is suitable for production or development.

The other types of automatic machines are at present not up to the output required. The whole secret lies in the feeding of leaves to the machine...... Unfortunately, your *Furcræa gigantea* is not strong enough to stand up to complete simultaneous decortication along its whole length and therefore entails the need for a gradual decortication. This in its turn, at the moment, entails an end feed. Owing to the fact that leaves vary much more in length then they do in width, any form of end feed entails a loss of time and the necessity for each leaf to be handled separately by the feeding operator...... For high outputs and the employment of very unskilled labour cross-feed is essential.

Let us now consider the requirements for the second phase of development. The ultimate requirements for an output of 5,000 tons per annum could be, let us say, 25 machines producing 1 ton dry fibre per day for 200 days per annum. I think that there is time to design, manufacture, test such a machine before any new areas of leaf, which may be planted, come into bearing.

It has been proved to many people's satisfaction in this island that the standard type of sisal decorticator is unsuitable for Furcræa.

As you are probably aware, a "Corona" decorticator was installed in 1916 ; with Furcræa the results appear to have been hopeless. It was again tried in 1926 with little improvement and the machine eventually became a dead loss. A Robey machine was installed in 1922 for use with sisal ; it also appears to have been a failure with Furcræa, and has, I believe, disappeared as scrap iron...

I should very much like to have experimented with either or both of these machines, but, unfortunately, that is now out of the question and I must accept the findings of the previous experimenters.

I see no reason why a machine could not be made to deal with Furcræa and to obtain the output required, but I would like to stress the point that in the processing of fibrous leaves and other kindred articles,

it is almost impossible to set down on paper a design which will be 100 per cent efficient at the first try. It is unfortunate that manufacturers in Europe have not got the facilities for testing such machines under output conditions. On occasion, a few selected leaves have been sent for experimental purposes, but the performance of a leaf at a time is nearly always very different to that of bundles of leaves of varied length and sizes for 8 hours a day., 200 days in a year.

As far as power is concerned, there is no reason why factories should not use electric power if that power were to be available; it is a much easier thing to start up a motor or two every day and let some one else have the headache of producing the power, than to keep a gas, oil or steam machine running in good order. All sisal factories in East Africa, which were able to discard their engines in favour of electric power, did so when electric power became available in 1936-37. This is extremely efficient. Drying lines in most fibre factories are very poor. A good drying ground with permanent posts and galvanised wires, kept clean, with the grass kept short, will definitely pay for itself in a very short time and require little maintenance.

Now I come to what I consider the most important point after factories, that of the supply of water. If your output goes up, you will require more water, if only to dispose of your waste without the use of labour. A factory producing 1 ton of dry fibre per day, should, in my opinion, have a supply of at least 100 gallons, or 450 litres per minute. The bulk of this should actually pass through the decorticator with the leaf and then into the waste flumes.

If factories are to be rebuilt, they should in many cases be re-sited so as to give a certain amount of fall to the waste. Preferably alongside a small valley or declivity. If factories are to be resited, I think that expert advice should be taken on the possibility of underground sources of water which could be tapped by boring .. .. This is a procedure which has been carried out with great success in East Africa. Find your water, pick a suitable site as near as possible to the water and then build your factory..................

One point I should like to mention, with regard to leaf. There is a great liking for excessively long leaf here. It is claimed that it holds more fibre than short leaf .... I do not believe that this is true but anyway, I will say that if the harvesting of long leaves of 5 feet or over is encouraged, then your automatic decorticator becomes a machine out of all proportions both from the point of view of size and also of cost. 4' — 6" is a good length for a leaf. I believe that Mr. Lock has something to say on that subject. In any case, all fibre is cut up into 22" lengths at the sack factory where the view is held that excessively long fibre is a nuisance.

Leaf arrives at tho factories in a bad state, particularly the long leaves. Moreover, very little attempt is made to stack the day's cut sepa-

rately so that it may be processed in rotation with a consequent considerable loss of leaf which deteriorates rapidly when it is left at the bottom of the pile for days on end.

You may possibly be thinking that I have been talking about a lot of things that have little to do with decortication, but I would like to point out that they all have to do with output. It is no good having a decorticator capable of a certain output if its ancillaries are only capable of dealing with half of that output. If any branch of the factory is overloaded you will get labour trouble, that is, the worst trouble of all It's infectious. I think that one of your biggest problems in connection with a high output would not be machinery, but would be cutting and hauling.

With proper plantations, your cutting cost per ton of fibre produced can go down, but your hauling costs may go up as the distances involved may be greater.

Well gentlemen, that is all I have to say on the subject, except to add that, in my opinion, you have the foundations of a fine industry here, which should be invaluable to the island in so far as the bagging of sugar is concerned and, if you produced more fibre than the sugar industry requires, then no doubt you could sell it advantageously elsewhere in the form of bags.

Before concluding I would like to thank all the gentlemen who have been so patient with me and who have given me every facility and courtesy on the occasion of my visits to them. I would also like to thank your chairman who has been the most helpful all along.

I must also thank the Director of Agriculture who has placed every facility at my disposal, Mr. North Coombes who has answered dozens of questions, and especially, Mr. Haddon, of the Department of Agriculture, who never complained at being remorselessly dragged all over the island and was throughout of great assistance to me..............................

SOCIÉTÉ DES CHIMISTES ET DES TECHNICIENS DES INDUSTRIES AGRICOLES DE MAURICE

Conférence sucrière tenue le 29 et le 30 mai 1946. (suite)

Communication de Monsieur Roger Bax.

Messieurs,

Notre collègue Vivian Olivier a très clairement fait ressortir le rôle extrêmement important du cuitomètre dans le contrôle du travail des appareils à cuire.

J'ajouterai simplement quelques mots sur l'importance, pour le cuitomètre, de la régularité du courant et des méthodes employées pour la production de ce courant.

Le cuitomètre, comme vous le savez, emploie le courant alternatif en raison de la polarisation aux électrodes avec le courant continu, mais il est absolument essentiel que ce courant soit régulier, autrement les indications du cuitomètre seraient erratiques et le bouilleur bien vite dérouté.

Trois exemples, entre autres, suffiraient pour faire ressortir la nécessité d'un courant régulier pour le travail du cuitomètre :

1o. *Le Grainage.* Le bouilleur, après quelques essais, arrive à savoir qu'il doit introduire la poudre de sucre dans le vide, lorsque l'aiguille du milli-ampèremètre est à un certain point.

Si le courant est toujours régulier, cette poudre de sucre introduite dans le vide au degré de sursaturation voulu, comme indiqué par le milli-ampèremètre, servira de noyau à la crystallisation subséquente, et si la cuite est bien menée, toujours à l'aide du cuitomètre, elle se composera à sa coulée, que des grains qui ont été introduits par la poudre de sucre et qui auront alors grossi très régulièrement.

Si par contre le courant est irrégulier au moment du grainage, et par conséquent les indications du milli-ampèremètre mauvaises, il se passera alors ceci: soit que la poudre de sucre sera introduite trop tôt et sera partiellement ou totalement dissoute, ou qu'alors elle sera introduite trop tard, créant dans la solution, trop sursaturée, un choc qui fera sortir en masse d'autres grains et la cuite ainsi obtenue n'aura pas les qualités voulues.

Elle pourrait être très difficile au turbinage et produirait dans ce cas un sucre de mauvaise qualité et un égout moins épuisé.

2o. *Conduite de la Cuite.* Le grain formé, la sursaturation devra être réglée de façon que la crystalisation soit régulière jusqu'à la fin de la cuite, mais si le courant est par moments irrégulier et les indications du milli-ampèremètre ainsi erratiques, le bouilleur risquera de pousser la sursaturation parfois trop loin et fera apparaître de faux grains dans sa cuite ou il alimentera trop librement et causera non seulement une refonte de cristaux, mais aussi une perte de temps aux vides.

3o. *Serrage.* Une variation du courant, et par conséquent une fausse indication du milli ampèremètre, aurait à cette étape comme conséquence, la production d'une masse cuite n'ayant pas le Brix désiré.

Si le Brix est trop fort il y aura risque de formation de faux grains et s'il est trop faible l'eau mère de la masse cuite sera plus riche et la masse cuite rendra moins de sucre. Dans le cas de la dernière masse cuite l'épuisement maximum de la mélasse ne sera pas atteint.

Il semblerait donc qu'il n'est pas nécessaire d'insister davantage sur l'importance de la régularité du courant pour le bon fonctionnement du cuitomètre et il ne serait pas exagéré de dire que l'emploi de ces appareils serait non seulement inutile mais même dangereux sans un courant régulier.

Arrivons maintenant aux installations employées à fournir le courant aux cuitomètres.

1o. *Le courant alternatif de 240 volts provenant d'une station électrique* telle que celle de Curepipe ou de Rose Hill.

Ce courant est réduit aux environs de 12 volts par un transformateur en circuit avec chaque milli-ampèremètre.

Le courant de 240 volts ainsi obtenu offre de grands avantages : *Il y a économie de machines et de main-d'œuvre, mais malheureusement, elle n'est accessible* qu'à quelques usines.

Toutefois, ce courant n'est pas exempt de variations.

Le transformateur en circuit avec chaque milli-ampèremètre peut être à un ou à plusieurs plots, et dans ce dernier cas, il est possible de varier le voltage aux milli-ampèremètres afin d'élargir, si nécessaire, les limites d'oscillation de l'aiguille.

2o. *Le courant continu d'une dynamo faisant marcher un moteur électrique accouplé directement à un alternateur de 240 volts.* Ce courant est également réduit à la suite aux environs de 12 volts, par un transformateur en circuit avec chaque milli-ampèremètre.

En général, la dynamo est menée *directement* ou *indirectement* par un

moteur à vapeur. Ce moteur subit les variations du régime de vapeur, inévitable dans toute usine, et par conséquent sa vitesse varie aussi et le courant obtenu n'est pas régulier.

Ce système présente, en outre, le désavantage dans bien des cas de faire travailler un moteur et une grosse dynamo pendant toute la journée, uniquement pour les besoins des cuitomètres.

Il y a donc dépréciation plus rapide des machines et coût additionnel de main-d'œuvre.

3o. *L'alternateur est mené par une transmission quelconque avec démultiplication.*

Dans ce cas, comme dans le précédent, le courant est généralement irrégulier, d'autant plus que toute démultiplication de vitesse implique l'usage de plusieurs courroies et par conséquent un pourcentage plus ou moins variable de glissement.

Ce système a, toutefois sur le précédent, l'avantage de l'économie de dynamo et de main-d'œuvre.

4o. *L'alternateur est mené par une turbine hydraulique au moyen d'une courroie.*

Notre collègue Léon Bourgault fut, je crois, le premier à Maurice à mettre en pratique ce système qui est jusqu'ici le plus élégant, mais cette installation demande un volume d'eau adéquat et surtout une tête d'eau constante.

Le courant ainsi obtenu est parfaitement régulier.

5o. *L'alternateur est accouplé directement à une turbine à vapeur.*

Vivian Olivier a mis au point cette installation la coupe dernière à l'usine de Savinia, les résultats qu'il a obtenus ont été très satisfaisants. Le courant n'est pas affecté par de petites variations dans le régime de vapeur, mais dans le cas de fluctuations assez grandes, il est nécessaire de varier le réglage du régulateur de la turbine.

Messieurs, nous avons fait une brève récapitulation des installations existant actuellement pour fournir aux milli-ampèremètres le courant nécessaire à leur fonctionnement.

Nous arriverions maintenant à une installation nouvelle dont l'idée vient de notre regretté collègue Auguste Esnouf, mais qui fût développée et mise au point par notre collègue Serge Staub.

Cette installation extrêmement intéressante et dont j'aurai le plaisir de vous faire une petite démonstration, offre beaucoup d'avantages.

Elle est appelée à supplanter, dans beaucoup de cas, celles dont nous avons parlé plus haut.

L'Installation comprend les unités suivantes :

1o. 3 accumulateurs de 12 volts dont deux en service et le troisième en charge.

Des bornes additionnelles sont fixées à deux ou trois autres cellules afin de permettre à l'usinier d'obtenir le voltage qu'il désire aux milli-ampèremètres.

2o. Le Hacheur de courant.

3o. Les milli-ampèremètres, sans aucun transformateur.

4o. Un voltmètre de 0-16 volts.

Ces deux dernières unités forment déjà partie de toute installation de cuitomètres et ne nécessitent donc ici aucune mention spéciale.

Les accumulateurs. Si nous examinions la courbe de décharge d'un accumulateur à plaques de plomb, nous remarquerons qu'elle est absolument régulière pendant toute la période de décharge sauf au début lorsque l'accumulateur a reçu une charge maximum.

Il serait facile d'éviter cette charge maximum en retirant l'accumulateur de la charge lorsque son voltage commence à dépasser deux unités par cellule. Au cas même où la charge maximum serait atteinte, l'on aurait alors la possibilité de court circuiter l'accumulateur afin de ramener son voltage à 2 unités par cellule.

L'accumulateur pourrait alors assurer un courant constant pendant toute sa période de décharge et être remplacé avant que le voltage ne tombe au-dessous de 2 unités par cellule.

Je présume qu'un accumulateur pourrait être mis en charge chaque nuit à tour de rôle.

Des accumulateurs travaillant ainsi dans des conditions exemptes de chocs pourraient durer très longtemps, peut-être six ou sept ans.

Par conséquent la dépense annuelle pour leur remplacement n'est guère un désavantage à considérer.

Nous pourrions aussi considérer l'emploi d'accumulateurs Ferro-Nickel qui offrent quelques avantages assez intéressants.

1o Ces accumulateurs sont très robustes et résistants aux excès de charge et de décharge.

2o La résistance intérieure est relativement élevée et par conséquent le court circuit n'est pas détrimentaire.

3o Les cellules ne sont pratiquement pas affectées lorsque l'accumulateur est hors de service pendant plusieurs mois consécutifs.

4o La durée d'une cellule est de 3000 à 4000 cycles complets de charge et de décharge.

Nous remarquerons cependant que la courbe de décharge n'est pas aussi régulière que celle de l'accumulateur à plomb, mais le taux de décharge est relativement si faible dans le cas des cuitomètres que l'avantage pourrait être au Ferro-Nickel.

Le Hacheur de Courant.

Cet appareil, dont vous pouvez voir les détails sur les bleus, prend le courant des accumulateurs par quatre balais opérant en ligne sur une moitié de la surface du rotor et delivre le courant alternatif à quatre autres balais opérant sur l'autre moitié du rotor.

Avantages.

1. L'appareil peut s'adapter à n'importe quel mouvement tournant, de préférence entre 250 et 300 tours par minute.

Il peut aussi bien être mené par courroie de toute transmission appropriée.

2. Toute variation de vitesse, dans les limites rencontrées en pratique, n'affecte nullement le voltage obtenu et le courant est par conséquent absolument régulier.

3. Le voltage aux milli-ampèremètres peut être varié à volonté par chiffres paires entre les extrêmes pratiques de 6 à 13 volts.

4. Il y a suppression de toute machine électrique et même de transformateurs nécessaires avec les autres installations, par conséquent élimination de toute complication électrique.

5. La construction est extrêmement robuste et durable. Somme toute, les avantages de cette installation se résument en trois mots :

Simplicité, Solidité, Précision.

Je crois, Messieurs, que cette nouvelle installation est pleine de promesses et vous demanderai à vous joindre à moi pour présenter, à notre collègue Staub, nos bien vives félicitations.

....

M. Roger Bax fit ensuite une démonstration de l'appareil, au cours de laquelle on remarqua la stabilité des indications aux milli-ampèremètres, lesquelles indications ne furent pratiquement pas influencées par une légère variation de la vitesse du rotor.

LE JARDIN POTAGER

(CAUSERIES RADIO-DIFFUSÉES)

PAR

G. A. NORTH COOMBES,
Senior Agricultural Officer, Department of Agriculture

TABLE DES MATIÈRES

AVANT-PROPOS

La culture des légumes à Maurice est pour de nombreuses personnes un passe-temps agréable tandis qu'elle constitue une petite industrie très rémunératrice pour beaucoup de maraîchers. Cette industrie n'a pas encore bénéficié chez nous de l'application de certaines pratiques modernes, tant culturales que phytosanitaires, qui peuvent lui être d'un secours considérable et qui sont faciles à adopter. D'autre part, il n'existe aucun livre récent sur la culture potagère sous notre climat.

Dans le but d'essayer de combler, assez imparfaitement d'ailleurs, quelques-unes de ces lacunes, j'entrepris de faire, d'avril à octobre de cette année, une série de causeries radio diffusées. Ces causeries ayant eu quelque succès, plusieurs personnes ont témoigné le désir de les avoir sous la main sous forme imprimée en attendant le jour où paraîtra peut-être un manuel plus complet de la culture des légumes à Maurice.

Je tiens à rendre hommage ici à Monsieur J. H. JULIEN pour de nombreuses suggestions, ainsi qu'à Messieurs P. O. WIEHE et A. MOUTIA qui ont bien voulu m'aider de leurs conseils au sujet des maladies et des pestes respectivement. J'ai aussi puisé certains renseignements de quelques brochures, principalement dans le livret du Révérend Père J. . PIVAULT, c.s.sp., " La culture des légumes dans les îles de Maurice et de Rodrigues (1929) " et dans " Home Gardening in Hawaii (1945) " par W. A. FRAZIER.

A. NORTH COOMBES,
Senior Agricultural Officer
Department of Agriculture.

VACOAS
15th November 1947.

1ère Causerie

MERCREDI 2 AVRIL, 1947.

Introduction — Site du jardin — Protection contre le vent — Outils — Semis du mois d'avril.

La situation alimentaire mondiale est grave. Elle restera précaire de longs mois encore. On peut supposer qu'il n'y aura pas d'amélioration sensible avant la fin de 1948. L'hiver extrêmement dur en Europe, les troubles intérieurs de maints pays producteurs de denrées sont autant de facteurs qui retarderont le retour à des conditions plus ou moins normales.

Maurice, pays sucrier par excellence qui doit importer la majeure partie de la nourriture de ses nombreux habitants—n'oublions pas que notre île a une concentration de population d'environ six cents âmes par mille carré—se trouve dans une position particulièrement difficile au point de vue alimentaire.

Il convient donc que nous produisions tout ce dont nous sommes capables pour parfaire les rations de denrées importées. Il est impératif qu'aucune terre cultivable ne reste inutilisée ; que chacun y mette du sien et fasse un effort spécial pour aider à surmonter les difficultés de l'heure présente.

Des mesures ont déjà été prises, d'autres sont en voie de réalisation,

pour encourager chez nous la culture de plantes vivrières sur une plus grande échelle. C'est dans ce but que le " Mauritius Broadcasting Service " diffusera les premiers et troisièmes mercredis des mois qui vont suivre des causeries agricoles. Je vous parlerai tout particulièrement du jardin potager tandis que Monsieur André d'Emmerez de Charmoy vous entretiendra de questions agricoles générales afin, nous l'espérons, de vous aider dans la mesure de nos faibles moyens, à tirer le meilleur parti possible de vos cultures.

Le climat de Maurice convient merveilleusement au jardinage. Ici point d'hiver, la nature ne demande pas de repos, il suffit de varier les cultures avec les saisons.

Tout le monde peut être jardinier et tout le monde, par les temps actuels, devrait l'être ; les uns trouveront dans le jardinage un exercice salutaire et une distraction agréable ; les autres un supplément de travail à leur tâche quotidienne c'est vrai, mais aussi un supplément de ressources. Surtout, le pays produira en plus grande abondance des éléments nutritifs que rien d'autre ne peut remplacer.

C'est le temps en général qui manque le moins ; il s'agit simplement de vouloir le trouver—quelques moments le soir et le matin, les après-midis du jeudi et du samedi, les jours de congé. Que l'on proportionne l'étendue de son jardin au temps dont on dispose. Un petit jardin bien soigné rapporte autant qu'un grand mal entretenu ; il coûte moins cher et plaît davantage.

Pendant au moins deux siècles la culture des légumes a été faite avec succès à Maurice. Il n'y a pas de raison valable pour que notre île ne produise pas en plus grande quantité une succession de légumes tout le long de l'année. Cependant, c'est surtout en hiver que notre climat est idéal pour la culture de nombreux légumes. En été, et sur le littoral, la sécheresse d'une part et les fortes températures diurnes d'autre part militent contre la plantation de certaines espèces. A cette réserve près, le climat permet la réussite de beaucoup de légumes en un laps de temps relativement court donnant plusieurs récoltes dans l'année. Toutefois la température assez élevée favorise le développement d'insectes nuisibles et de maladies cryptogamiques qui découragent quelquefois le jardinier. Il faut bien se dire que là où il y a des jardins, il y a aussi des insectes et des maladies. Il s'agit de lutter contre eux et de les vaincre. J'y reviendrai au cours d'une autre causerie. Qu'il me suffise ce soir de dire que si l'on néglige les principes de base même de la culture des légumes, c'est-à-dire la rigoureuse sélection des variétés et le contrôle, non moins rigoureux, des insectes et des maladies, on doit s'attendre à l'insuccès. De nos jours, il n'est plus permis de baisser pavillon devant ces obstacles.

Du point de vue de l'utilisation des terres, l'île Maurice peut être considérée comme un vieux pays. Toutes ou presque toutes les terres utilisables sont sous culture. On ne peut donc choisir le site du jardin. Si cependant on peut le faire il convient que le jardin soit autant que pos-

sible à proximité de la maison ; on évitera le voisinage de grands arbres, de haies, notamment de haies de bambous et de " bread and cheese ; " on l'orientera de façon à obtenir le maximum d'ensoleillement ; et de préférence on l'établira sur un terrain plat plutôt qu'accidenté.

La protection du jardin contre les vents est assez mal comprise chez nous. Dans un pays à cyclones cela semble paradoxal : c'est que étant habitué aux violentes poussées cycloniques on ne fait plus attention aux alizés. Cependant, on ne saurait mieux faire que de protéger le jardin contre ces vents, le manque de protection étant souvent la cause principale sinon d'insuccès complet du moins de succès assez médiocre. Il n'est pas nécessaire, il est même peu recommandable d'établir des écrans d'arbres à haute futaie. On ne dispose pas assez de terrain pour le faire et la protection qu'ils donneraient ne compenserait pas le sacrifice de terre. Il n'est pas besoin de vous dire que, contre les cyclones, les brise-vents, souvent, ne donnent pas la garantie à laquelle on s'attend. Nous n'envisagerons ici que la protection de nos jardins potagers contre les alizés. Pour la réaliser de façon assez satisfaisante, sinon parfaite, il suffit de planter à intervalles, et perpendiculairement à la direction générale des vents, une ou deux rangées de bananiers ou d'embrevades ; le maïs, planté très près sur trois ou quatre rangs, conviendra quelquefois lorsqu'on n'aura besoin que d'une protection temporaire ; on peut encore avoir recours à un barrage de bambous secs ou de feuilles de palmier ou de latanier, ou bien de fil métallique sur lequel on laisse filer une plante grimpante, telle que pois du Cap, pipengaille, petit pois téléphone, ou autre.

A Maurice les jardins de famille sont assez bien protégés. Par contre, les maraîchers, même ceux qui sont des jardiniers experts, attachent très peu d'importance à la protection contre le vent. C'est un état de choses à déplorer mais on explique facilement l'absence de clôtures et de brise-vents dans leurs jardins : c'est pour mieux dépister les voleurs, parasites qui vivent aux dépens de durs tâcherons et dont le nombre, hélas ! ne diminue pas.

Passons maintenant aux outils du jardin. Si je vous en parle au cours de cette première causerie, c'est qu'il est très important de se procurer les instruments essentiels avant de commencer les opérations de jardinage.

Chez nous on a trop tendance à négliger ce facteur ; on se contente trop facilement de quelques outils seulement, quelquefois en assez mauvais état. La pioche ne sert qu'à défricher l'emplacement destiné au jardin, à extraire les pierres et les grosses racines, et à défoncer les terres trop résistantes pour les autres outils. Son rôle s'arrête à peu près là, mais chez nous on la met à tort, à toute contribution. On l'emploie à la place de la houe qui sert à labourer, à détruire les grandes herbes, à faire les poquets

ou fossés, etc. On doit en avoir deux modèles au moins. La houe est l'outil No. 1 du jardinier, et cependant on la rencontre rarement dans nos jardins. La bêche qui en Europe est si utile ne sera jamais populaire ici grâce à la pioche. Nous la passerons sous silence. Par contre la *fourche à bêcher*—nous disons ici *fourchette* (à quatre dents)—devrait trouver une place encore plus grande dans nos jardins même les plus petits : elle permet de défoncer le sol sans se baisser. Son maniement constitue un excellent exercice après une journée sédentaire au bureau. Le *rateau* doit être en acier avec des dents recourbées. Son usage est indispensable pour égaliser la surface des planches de semis—ce que font toujours nos jardiniers avec les mains. Je ne parlerai que pour mémoire des plantoirs et transplantoirs, des arrosoirs, du cordeau, de la fourche à fumier, des grattes ou sarcloirs. Mais il y a encore quelques outils dont le bon jardinier de l'an de grâce 1947 ne saurait se passer et dont l'usage est presque inconnu dans nos jardins. D'abord, *le croc à col de cygne* à quatre dents, indispensable pour les terres soumises à une culture intense, comme doit l'être celles d'un jardin. Cet outil, léger comme un joujou, fait un excellent travail. Le *petit sarcloir a cinq dents*, le '*claw weeder*' des Anglais, est fort utile pour sarcler autour des plants et pour briser la croûte qui se forme à la surface des planches à la suite d'arrosages fréquents. Si le jardin est un peu grand il est bon de se munir d'une *brouette*. Ici l'on ne connaît que le panier. On ne peut plus se passer de nos jours d'un petit *pulvérisateur*, surtout dans les quartiers humides ; dans les quartiers secs, où l'on peut irriguer, on aura avantage à posséder un *soufflet*. Les pulvérisateurs projettent en gouttelettes fines des liquides ou bouillies dans le but de détruire les parasites, animaux ou végétaux, et particulièrement dans le traitement des maladies cryptogamiques. Enfin, une cuiller à café et une cuiller à dessert, volées à la cuisine, serviront à mesurer les insecticides, les fongicides, voire même les engrais employés en dilution et en petites quantités. Si vous n'avez pas encore tous les outils essentiels, que cela ne vous empêche pas de vous mettre tout de suite à l'œuvre.

Je n'ai que le temps de vous dire que nous voici en avril, mois où l'on sème en grand les légumes propres aux pays tempérés. Dans les hauts, vous avez sans doute semé en caisses depuis le commencement du mois dernier ; après le 15 mars vous avez semé plus abondamment vos laitues romaines, chicorées, scaroles, poirées, et en petites quantités les choux pommés hâtifs, choux navets, choux fleurs, petsaïs, oignons, pommes d'amour, bringelles, navets, carottes, etc. En avril les grosses pluies d'été ne sont plus guère à craindre. Transplantez, à mesure qu'ils auront le développement suffisant, les légumes qui doivent être changés de place comme choux et laitues. Eclaircissez les planches de navets, raves, carottes. Semez en grand tous les légumes que je viens d'énumérer ainsi que betteraves, cresson alénois, épinards, céleri persil frisé, persil commun, thym, radis, poireaux, échalottes, pommes de terre, haricots, petits pois, tomates, choux de Chine. Avril est aussi le mois ou l'on sème anis, boemes, lentilles et ...... asperges.

2ème Causerie

Mercredi 7 Mai, 1947.

Préparation du sol — Planches — Fumure des planches — Engrais chimiques — Guano phosphaté — Travaux du mois de mai.

C'est de la préparation du sol de votre jardin et de sa fumure que je vais vous entretenir ce soir. S'il est de mise que la terre du jardin doit être assez fertile, la culture intensive permet d atteindre le degré de fertilité voulu même en partant d'un sol relativement ingrat. En fin de compte le succès d'un potager dépend moins du sol lui-même que de sa préparation, son amélioration et les facilités d'arrosage.

Les agronomes et les horticulteurs par formation, ou si vous préférez par déformation professionnelle, ont coutume de dire que la culture des légumes exige un sol riche, profond et relativement léger. Nos latérites ne sont ordinairement ni riches ni profonds. Le terrain idéal est assez rare : il faut donc l'améliorer artificiellement. On pourrait dire de la plupart de nos jardins que leur couche de terre arable n'est pas assez profonde. Il serait donc avantageux d'approfondir cette couche de terre en ayant soin de ne pas ramener le tuf à la surface.

S'il y a lieu on commence par défricher le terrain. Toutes les matières susceptibles de se décomposer rapidement sont enfouies ou entassées, les broussailles sont brûlées. On défonce avec la fourchette et on laisse le sol ainsi défoncé exposé au soleil pendant quelques jours avant de biner à la pioche jusqu'à profondeur du sous-sol qui se trouve généralement à Maurice assez près de la surface. A chaque occasion qui se présentera on binera un peu plus profondement — mais c'est un travail assez lourd que votre jardinier ne fera certainement pas à votre satisfaction sans une surveillance de tous les instants.

Le moyen le plus simple, et celui que vous adopterez probablement, est de défoncer avec la grosse fourchette de trois dents, suivi par un bon binage à la pioche; on obtient de cette façon d'excellents résultats. Si cependant vous êtes un jardinier passionné, et si votre coin de terre mérite toute votre attention, vous creuserez à la pioche, à l'une des extrémités du terrain, une tranchée de 5 à 6 pieds de largeur sur une profondeur égale à l'épaisseur de la couche arable ; la terre retirée sera transportée à l'extrémité opposée du jardin. Creusez ensuite, à côté de la première, une seconde tranchée dont la terre servira à combler celle-ci, et ainsi de suite, jusqu'à ce que vous arriviez à la dernière tranchée que vous remplirez avec la terre retirée de la première. Mais, au préalable, défoncez le sous-sol en place, exposez-le à l'air et au soleil avant de le recouvrir de la terre de la tranchée avoisinante. Vous pouvez faire mieux encore. Avant de recouvrir le sous-sol ainsi défoncé avec la terre végétale, couvrez-le d'une couche de fumier, de terreau, de composte, ou même de

toute matière organique provenant du nettoyage du jardin. S'il s'agit d'un grand jardin, on divise celui-ci en parcelles et l'on approfondit chaque année une ou plusienrs parcelles, selon ces moyens et le temps dont on dispose. Au bout de quelques années la terre végétale sera devenue sensiblement plus profonde.

A la fin d'un travail de ce genre vous vous trouverez probablement en présence d'un amoncellement de pierres qui serviront à la construction des petites allées et sentiers du jardin. Vous pourrez encore les entasser dans un coin, sur un pavé ou ailleurs, ou le long de la périphérie du potager, et en tirer parti en faisant filer dessus quelque légume grimpant. Les grosses pierres peuvent aussi servir à faire un mur de soutènement ou une succession de petites terrasses si le terrain est en pente.

Si l'on ne dispose que d'une surface rocheuse, on ne songera pas à un grand jardin. Petit à petit, en enlevant les pierres, en transportant de temps en temps un panier de terre ramassée au plus près, on a tôt fait de créer une planche où pousseront à merveille, avec un peu de fumier, des laitues, radis, betteraves etc.

Le plus souvent, l'emplacement du jardin — sauf, bien entendu, dans les terres dites " franches " est formé de rocailles et de graviers. Il faut alors enlever les plus gros. Les légumes que l'on ne cultive pas spécialement pour leurs racines viendront bien dans ce terrain : plus tard on enlèvera les graviers, à l'exception des tout petits qui ne nuisent pas aux jardins, afin de pouvoir y accommoder les légumes-racines : carottes, panais, salsifis.

A ce stade de préparation du terrain on peut, soit faire les planches, soit faire les apports de fumier. Deux ou trois semaines avant de planter on répand, sur toute la surface, du fumier bien pourri au taux de 500 grammes par pied carré, ce qui équivaut à une fumure de 20 tonnes à l'arpent, que l'on incorpore au sol par un binage de 6 à 8 pouces de profondeur. Il est quelquefois recommandé de répandre à la volée, avant l'épandage du fumier, un engrais complet — azote, acide phosphorique, potasse — au taux de deux livres par 100 pieds carrés, c'est-à-dire de 800 livres à l'arpent. Puis, on fait les planches.

On opère, chez nous, d'une façon différente et fort recommendable : nous faisons les planches d'abord, et les fumons ensuite. Si la planche doit recevoir un semis à la volée ou dans des rayons fort rapprochés les uns des autres on répand le fumier sur toute la surface de la planche avant de l'enfouir par un binage. Si cependant les plants ont un plus grand rayon de développement, le fumier est placé au fond des sillons ou des poquets. Vous emploierez de la sorte bien moins de fumier et produirez de plus beaux légumes.

Puisque nous voici parlant des planches, voyons un peu si nous devons faire soit des planches surélevées, soit des planches à même le niveau du sol. Les planches surélevées, de 3½ à 4 pieds de largeur, séparées les unes des autres par de petits sentiers de 12 à 15 pouces, sont fréquentes dans nos jardins. La planche surélevée s'impose dans les en-

droits à drainage défectueux, les localités à forte pluviosité, et les sols peu profonds, surtout pour les légumes-racines. Elle est contre-indiquée pour les localités relativement sèches, et là où le sol est suffisamment poreux ; elle n'est pas recommandée là où l'on peut arroser par irrigation.

Dans nos potagers proprement dits on préfèrera toujours les planches surélevées ; elles donnent un cachet particulier qui flatte l'œil et invite les compliments des visiteurs. Nos maraîchers, par contre, gagneraient à ne les employer qu'à des fins strictement définies car leur préparation demande plus de soin et coûte davantage ; elles demandent aussi des arrosages plus fréquents car elles se dessèchent plus facilement que les planches à même le sol.

Vous tracerez toujours les planches au cordeau. Rien n'est plus vilain dans un jardin qu'une planche dont les bords ne sont pas parfaitement rectilignes.

Je vous indiquais tout à l'heure, assez sommairement, je l'avoue, l'usage du fumier dans le jardin. Vous ne pouvez pas toujours vous procurer de bon fumier. Chez nous on dispose souvent d'écume de filtre-presse provenant des sucreries. Vous l'emploierez seulement après un séjour de quelques mois ; son emploi à l'état vert peut occasionner un jaunissement de vos légumes—provoqué par une immobilisation temporaire de l'azote du sol—ce qui nuira beaucoup à leur pousse ultérieure Vous pouvez aussi, vous devez, faire usage de terreau, de composte. Un bon cultivateur ne laisse rien perdre Réservez donc dans un coin de votre potager un petit emplacement creusé à 6 pouces de profondeur, où sont jetées les épluchures de légumes, les vieilles feuilles, les herbes sèches, les rognures de gazon, les cendres provenant de la cuisine. Remuez et mélangez le tout de temps à autre et au bout de quelques mois toute cette matière organique sera transformée en terreau que vous emploierez à la place du fumier. Vous pouvez y ajouter la poulaiette provenant de votre poulailler.

Passons maintenant à l'usage des engrais chimiques. Le temps dont je dispose me permet tout juste de brosser ce sujet à grands traits.

Vous savez que les plantes ont besoin d'un certain nombre d'éléments nutritifs, dont les principaux sont l'azote, l'acide phosphorique, la potasse et quelquefois la chaux. Le fumier fournit un peu de ces éléments ; mais on doit parfaire la différence par des apports d'engrais chimiques, surtout d'engrais phosphatés. Cela est d'autant plus nécessaire que nos sols sont assez pauvres et que les légumes poussent vite, ne doivent subir aucun échec au cours de leur développement.

A Maurice, l'usage des engrais chimiques dans la culture des légumes est encore mal connu. On se contente trop souvent de fumier seulement ou de fumier suivi d'apports d'azote sous forme, généralement, de sulfate d'ammoniaque. Nous ne sommes plus au temps où l'on avait coutume de dire : " pour les légumes-foliacés, de l'azote ; pour les légumes-racines, de la potasse ; pour les légumes-fruits, de l'acide phosphorique. " Si vous voulez avoir de bons légumes en grande quantité, si vous tenez à retirer de votre jardin tout le produit qu'il peut fournir, il faut à tout prix, en

sus de l'azote, faire des apports d'acide phosphorique, de potasse et quelquefois de chaux. Dans certains jardins, si l'on peut à la rigueur se passer parfois de fumier, on ne doit jamais omettre l'usage d'engrais complets.

Voici la meilleure façon de procéder. De chaque côté et à 2 ou 3 pouces de l'alignement des plants, on creuse—avant de semer—deux petits sillons d'environ trois pouces de profondeur au fond desquels on dépose l'engrais. On peut à la rigueur se contenter d'un seul sillon. Après l'épandage on recouvre l'engrais avec de la terre. La meilleure pratique consiste à appliquer l'engrais complet au moment de la plantation. Lorsque les légumes ont bien levé, on fait un apport en surface, toujours à 2 ou 3 pouces le long des rangs, de sulfate d'ammoniaque, de nitrate de soude, de nitrate de chaux, ou même de nitrate de potasse.

Si l'on plante en poquets, et dans tous les cas où l'espacement entre les plants est relativement grand, comme pour les choux, choux-fleurs, petsais, tomates, bringelles, l'engrais est mis non pas tout le long du rang mais dans de petites bandes de 6 à 8 pouces de long de chaque côté des plantes.

A Maurice nous disposons d'acide phosphorique sous forme de guano phosphaté importé des Seychelles et des Iles à Huile. Son emploi, conjointement avec des engrais azotés et potassiques, coute moins cher que celui d'un engrais complet. On aura donc avantage à l'employer, surtout dans les jardins-maraîchers. Le guano phosphaté peut avantageusement être mis au fond des fossés ou sillons, tandis que l'azote et la potasse sont disposés en bandes le long des rangs, ainsi que je viens de vous l'indiquer.

A propos du guano phosphaté il faut vous dire que son utilité en jardinage est encore mal appréciée. Cela tient du fait qu'il est insoluble dans l'eau, d'où la déduction que ses effets sont lents à se manifester. Il est évident qu'il agit un peu plus lentement que les engrais phosphatés solubles, mais en pratique cela a très peu d'importance. L'expérience du reste a été faite au Département de l'Agriculture où nous avons constaté un effet marqué sur des légumes aussi hatifs que la laitue et les haricots. Je me permets de vous conseiller fortement de l'employer au taux d'environ 300 livres à l'arpent.

Pour l'azote et la potasse il vous faudra par arpent soit 200 livres de sulfate d'ammoniaque et 75 livres de sulfate de potasse, soit 150 livres de sulfate d'ammoniaque et 100 livres de nitrate de potasse.

Avant de vous dire, puisque nous voici au début de mai, les soins que demande le potager en cette saison, ne perdez jamais de vue qu'aucun engrais chimique ne doit être mis en contact direct avec les semences, ni au-dessus de celles-ci. Les effets en seraient désastreux.

Les travaux du mois de mai sont très variés. Je n'ai guère besoin de vous les énumérer tous. Pas un seul petit coin de terre ne doit être vide. On continue les travaux du mois précédent ; on sème et on plante toutes

sortes de légumes ; on sarcle les semis d'avril , on éclaircit ceux qui sont trop touffus. On ne perdra pas de vue les plantes qui passent vite telles que radis, raves, épinards, laitues romaines, pois. Dans la première quinzaine on doit faire la grande plantation de haricots pour récolter en sec, sans omettre d'en semer fréquemment pour les cueillir verts. On œilletonne et on transplante les pieds d'artichauts. On sème des choux tardifs pour en avoir jusqu'en novembre.

Beaucoup de planches, dans presque tous les quartiers, sauf les plus humides, sont déjà débarrassées de leurs premiers produits , on remplacera les légumes enlevés par des légumes d'espèces différentes—selon les règles de l'assolement, sujet que j'aborderai, si ces causeries vous intéressent, au début du mois prochain.

3ème Causerie

Mercredi 4 Juin, 1947.

Choix des légumes à cultiver—Assolement—Groupes de légumes—Ensoleillement—Culture intercalaire—Travaux du mois de juin

Pour obtenir les meilleurs résultats de votre potager, il ne suffit pas, comme je vous le disais le mois dernier, de bien préparer le sol et de le fumer selon les règles mêmes de la science ; il faut aussi savoir et mettre en pratique une foule de choses dont la plupart ne s'apprennent ni dans les livres ni par des causeries radio-diffusées. Seule l'expérience vous guidera, l'expérience surtout de votre localité particulière. Il vous faudra aussi savoir grouper les légumes afin de pouvoir alterner les cultures au mieux de vos moyens. Il faut encore choisir les légumes qui s'adaptent le mieux à vos conditions et ceux qui font le plus de plaisir à votre famille.

Je m'adresse surtout à ceux d'entre vous qui cultivent un potager de moyenne grandeur, voire même un petit jardin. Dans ce cas, le choix des légumes à cultiver est assez facile. On laissera de côté les espèces qui demandent relativement plus d'espace pour leur développement, telles que patissons, artichauts, maïs, patates douces. On ne plantera pas des espèces que les maraîchers plantent en grand dans des localités particulièrement favorables à certains légumes tels que choux-fleurs, pomme de terre, arouilles et même choux. On n'inclura pas, dans un petit jardin, des légumes qui prennent un temps relativement long à donner leur produit, tels que cambarre, artichauts. Il ne faut pas oublier de tenir compte des goûts particuliers de la famille : on laissera de côté les espèces peu prisées telles que raves, angives. Au contraire, on fera la part la plus large possible aux légumes dont la valeur nutritive est le plus élevée, et parmi ceux-là les légumes consommés verts auront prépondérance. A ce propos,

tenez compte surtout de la qualité de l'eau d'arrosage. Après avoir écouté le Docteur Lavoipierre, vous savez les dangers, les risques que vous courez en consommant une eau impure ; si vous disposez d'eau de la Mare-aux-Vacoas plantez beaucoup de laitues, de radis, carottes, cresson alénois, chicorée frisée, que vous hésiterez d'acheter au marché afin de préserver votre famille de dysenterie, de typhoide et d'autres maladies infectieuses. Pour ce qui est des légumes filants et grimpants ils ne trouveront généralement place que dans les grands jardins ou chez les maraîchers et quelquefois en été dans les petits jardins.

Il semblerait, après cette énumération d'espèces qui ne devraient pas normalement trouver place dans un petit potager, que le choix de légumes pour celui-ci est presque nul. Cependant, voyons un peu ce qu'il nous reste : plusieurs variétés de laitue et de chicorée, cresson alénois, poirée, épinard, cèleri et cèleri-rave, betterave, navet, chounavet, radis, carotte, ognons, persil frisé, haricots verts, petits pois, tomates, aubergines, lalos, sans compter quelques bordures de thym, poireau, échalotte. Au total, vous avouerez que ce n'est pas mal.

Lorsqu'on a choisi les cultures à faire dans un jardin potager et assigné à chacune un emplacement convenable, il semble tout d'abord que le moyen le plus simple et le plus commode serait de se tenir constamment à cette disposition. Mais, toutes les cultures n'ont pas à l'égard des éléments nutritifs que fournit le sol des exigences égales. Il est donc nécessaire de pratiquer l'assolement.

L'assolement est la succession méthodique des cultures dans une exploitation agricole. On confond souvent ce terme à Maurice avec "rotation". La rotation des cultures n'est que la durée de l'assolement ; elle correspond au temps qui s'écoule pour la succession des différentes cultures.

Vous savez déjà que les plantes, pour se développer normalement, ont besoin d'un certain nombre d'éléments nutritifs, dont les principaux sont l'azote, l'acide phosphorique, la potasse et la chaux. Je passe les autres sous silence car ils se trouvent en quantité suffisante dans tout jardin bien entretenu. Toutes les cultures n'ayant pas à l'égard des éléments nutritifs que fournit le sol les mêmes exigences, il s'en trouve qui demandent une prépondérance d'azote, d'autres qui exigent plus d'acide phosphorique, d'autres plus de potasse ou de chaux. Un sol qui porterait toujours la même culture tend à s'épuiser de l'un ou de l'autre de ces éléments et les rendements, si l'on ne pratique pas l'assolement et les fumures, iront en diminuant.

Théoriquement, et pratiquement dans certaines cultures comme celle de la canne à sucre, on peut remplacer, par des engrais chimiques ou complémentaires, l'élément qui tend à faire défaut. Cette méthode réussit en certains cas, mais des considérations spéciales entrent en jeu qui imposent

la pratique rigoureuse de l'assolement dans la culture des légumes. Ainsi certaines espèces de légumes sont plus exigeantes que d'autres ; les plantes à racines superficielles épuisent la couche supérieure, tandis que les plantes à racines pivotantes utilisent les couches profondes du sol. Certains légumes sont hâtifs et doivent tout trouver à point, tandis que d'autres se développent plus lentement et donnent au sol un peu plus de temps pour libérer les éléments nutritifs exigés.

Dans les jardins l'assolement s'impose beaucoup plus qu'ailleurs grâce à l'incidence des maladies parasitaires et aux attaques d'insectes nuisibles. C'est là le facteur principal déterminant la pratique de l'assolement dans les jardins tropicaux. Les plantes cultivées sont toutes sujettes à des maladies, occasionnées soit par des insectes, soit par des champignons. Ces ennemis ne subsistent généralement que s'ils trouvent leurs plantes de prédilection. L'alternance des cultures, en les plaçant dans un milieu défavorable à leur existence, entraîne leur disparition ou, au moins, leur atténuation.

Le choix d'un assolement n'est pas toujours facile ; il est même, souvent, assez difficile. Avant de l'aborder, il sera utile de classer les légumes en divers groupes.

En premier lieu, nous avons les *Légumineuses*, c'est-à-dire des plantes de la tribu des Papilionacées qui ont la merveilleuse propriété d'utiliser l'azote de l'air et d'enrichir les terrains en azote, par les racines, les tiges ou les feuilles qu'elles laissent après la récolte. Pour cette raison, elles sont dites *plantes améliorantes.* Les légumineuses du jardin comprennent : haricot, petit pois, pois du Cap, bocla, voemes, soja, pois sabre, pistache, pistache malgache, embérique, embrevade, dolique, lentille, dholl kesari, pois carré.

En second lieu, nous avons les plantes cultivées pour leurs *Racines* ou leurs *Tubercules*, c'est-à-dire betterave, carotte, panais, radis, salsifis, navets, rave, pomme de terre, topinambour, cambarre, arouille, arouille carri, patate douce, manioc, corn flour, arrowroot, gingembre, safran.

Troisièmement, les légumes *Foliacés*, cultivés pour leurs tiges et feuilles, tels que épinard, chou, chou-fleur, chou-navet, petsaï, chou de Chine, brède martin, poireau, ognon. échalotte, laitue, chicorée, persil, thym, poirée, cèleri, cresson, asperge, brède d'Angole, ail, etc.

Quatrièmement, les plantes cultivées pour leurs *Fruits* : tomate, pomme d'amour, piment, piment-salade, bringelle, lalo, artichaut.

Et en dernier lieu, les légumes *Filants*, c'est-à-dire giraumon, citrouille, calebasse, calebasse Natal ou moëlle végétale, concombre, chou-

chou, pipengaille, margoze, melon, melon d'eau, et quoique pas strictement un filant, le pâtisson.

Je viens de vous dire que le choix d'un assolement n'est pas toujours facile. On ne pourra pas, à chaque occasion, faire un bon assolement, surtout dans un petit jardin. Mais, un mauvais assolement vaut tout de même mieux que rien. Je ne puis, ici, que vous indiquer les grandes lignes à suivre. Les voici :

(*a*) premièrement, remplacez les cultures les plus épuisantes par des plantes améliorantes, et les plantes à racines profondes par des plantes à racines superficielles ;

(*b*) deuxièmement, évitez de faire suivre un légume appartenant à la famille des crucifères, choux, choux-fleurs, petsaï, etc. par un autre légume de la même famille ;

(*c*) troisièmement, ne plantez pas des aubergines après des tomates ou des pommes d'amour, ni des tomates après des aubergines, et

(*d*) quatrièmement, ne plantez jamais le même légume de suite sur un même emplacement, même s'il s'agit d'une plante de la famille des légumineuses.

Revenons, un instant, aux divers groupes de légumes. En grande saison, c'est-à-dire d'avril à août on ne plante généralement pas de légumes filants dans les potagers à l'exception, quelquefois, d'une tonnelle de choux-choux ou d'une parcelle de pâtissons. Nous allons donc nous restreindre aux autres légumes. Le moment est venu de décider de leur emplacement dans le potager. Si l'assolement est le facteur principal à observer, il en est quelques autres que l'on ne saurait négliger.

D'abord, l'ensoleillement. Si presque tous les légumes demandent une exposition au grand soleil, il en est quelques-uns qui l'exigent à tout prix — ce sont les tomates, pommes d'amour, aubergines, haricots, lalos, petits pois et betteraves. On veillera donc à ce qu'ils obtiennent le maximum d'ensoleillement. A cet égard on aura soin de ne pas planter des haricots à l'ombre d'une ligne de pois carrés ou de lalos. Au contraire, on groupera ensemble les légumes de même taille tels que carottes, betteraves, navets, ognons d'une part et tomates, bringelles, petits pois téléphone d'autre part. Enfin on réservera une autre parcelle du potager aux légumes hâtifs, tels que radis, laitues, betteraves, haricots, afin de pouvoir replanter toute la parcelle à peu près en même temps.

Il est un point particulier sur lequel je voudrais attirer votre attention toute spéciale. Au cours d'une causerie précédente je vous disais que tout votre potager doit rapporter quelquechose ; qu'il fallait tirer partie de la moindre parcelle de terre disponible. Pour atteindre complètement ce but,

ne dédaignez pas la culture intercalaire, c'est-à-dire celle que l'on pratique entre les plantes à écartement relativement grand en utilisant les espaces restés libres. A Maurice on devrait lui faire une place plus large dans presque tous nos potagers. Les bons maraîchers de chez nous ne manquent pas de la pratiquer. Les légumes hâtifs, tout particulièrement les radis et les laitues, peuvent être plantés entre les lignes de légumes qui se développent plus lentement, tels que bringelle et tomate. Vous pouvez planter la laitue mignonette jusque entre les plants de choux. Quant aux radis, ils viennent si vite et occupent si peu de place que vous pouvez les semer entre les lignes de carottes, de betteraves et d'ognons si seulement vous le semez le même jour. De même que vous ne ferez pas une place spéciale pour le thym, les poireaux, les échalottes, le persil que vous planterez toujours en bordure.

Nous sommes au début de juin et le temps de l'abondance dans beaucoup de quartiers est arrivé. Les travaux du jardin sont très variés et je n'ai guère besoin de les énumérer tous. On sème, on plante et on récolte de tous les légumes ; on sarcle les semis du mois précédent ; on éclaircit ceux qui sont trop touffus.

Beaucoup de planches, dans presque toutes les localités, sauf les plus humides, sont déjà en état d'être replantées, c'est-à-dire qu'après avoir été débarrassées de leurs premiers produits, vous les avez binées et les avez fumées. Il ne vous reste plus qu'à remplacer les légumes enlevés par des légumes d'espèces différentes, selon les règles de l'assolement.

Vous visiterez votre jardin tous les jours si possible, et ne laisserez jamais passer deux jours sans un examen de tous vos légumes afin de parer à toute attaque d'insectes ou de maladies. Vous ne perdrez pas de vue les plantes qui passent vite, telles que radis, raves, épinards, laitues romaines, pois. Semez les souvent et peu à la fois.

Le début du mois de juin est le vrai moment de planter la pomme de terre. On continue les semis de poireau, échalotte, betterave, épinard, thym, piment, tomate, pomme d'amour, chicorée, laitue salsifis, carotte, cèleri, persil, choux, choux-fleur, choux-navet, choux de Chine, Petsaï, radis, rave, lentille, petit pois, bocla, brèdes, haricots.

(*a suivre*)

STATISTIQUES

1°. CLIMATOLOGIE

(a) Pluviométrie (Pouces)

Localités / Mois	Nord							Centre						
	Grand' Baie	Pamplemousses†	Pamplemousses (Normale)	Abercrombie	Abercrombie (Normale)	Ruisseau Rose	Belle Vue Maurel	Beau Bois (Moka)	Helvétia	Réduit	Réduit (Normale)	Curepipe*	Curepipe (Normale)
Nov. 1947	—	1.22	2.13	0.50	2.78	0.27	—	3.71	2.78	1.64	2.33	5.72	5.7
Déc. "	—	3.10	4.91	4.52	4.66	4.32	—	10.67	7.98	7.01	6.37	8.55	9.7

Localités / Mois	Est				Ouest					Sud			
	Centre de Flacq	Camp de Masque	Palmar	G.R.S.E.	Port-Louis	Case Noyale	Beau-Bassin	Beau-Bassin (Normale)	Richelieu	Rose Belle	Riche-en-Eau	Camp Diable	Chemin
Nov. 1947	2.64	3.24	1.30	1.64	0.59	1.44	1.65	2.31	1.25	5.29	—	2.86	4.62
Déc. "	7.79	5.95	6.65	5.59	8.46	3.11	4.49	5.78	1.66	9.58	—	6.23	5.91

(b) Température °C

Localités	Beau-Bassin		Réduit				Curepipe*		Richelieu	
Mois	Max.	Min.	Max.	Min.	Moy.	Nor.	Max.	Min.	Max.	Min.
Nov. 1947	27.8	17.3	25.9	16.8	20.9	21.8	23.3	16.4	28.1	21.4
Déc. "	28.3	19.4	27.5	19.8	23.4	23.4	25.7	19.3	29.4	22.5

(c) Insolation

	Réduit	
Mois	Heures de Soleil	Fraction d'insolation
Nov. 1947	245.10	62.8
Déc. "	272.05	66.1

*Collège Royal. † Jardin Botanique.